The Dock & Harbour Authority

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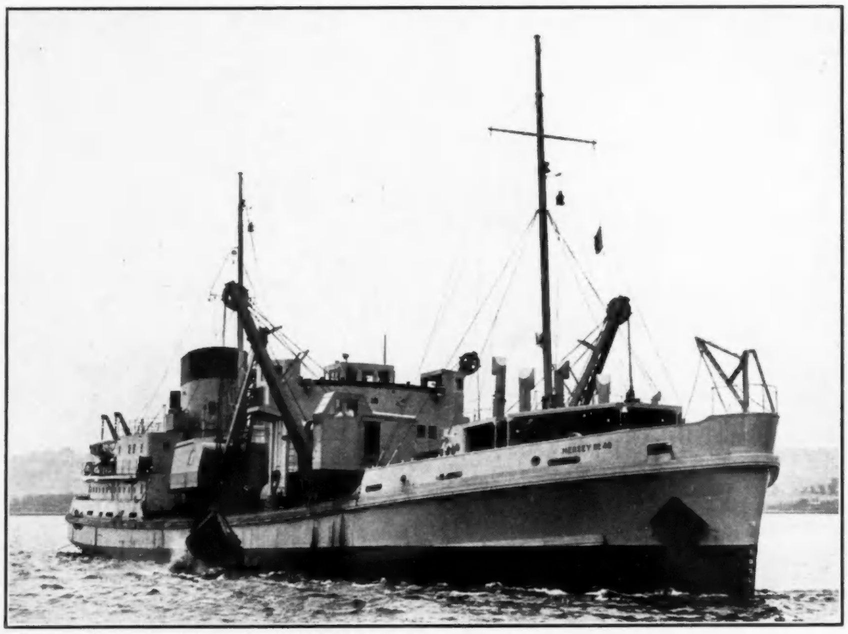
World's Largest Grab Dredger

The Mersey Docks and Harbour Board have recently taken delivery of the largest grab hopper dredger in the world. Built by Messrs. Lobnitz & Co. Ltd., Renfrew, " Mersey No. 40 " is a twin-screw diesel electric grab hopper dredger having four Priestman 7-ton electric grab cranes mounted on deck amidships. The vessel is propelled by two pressure-charged uni-directional diesel engines, each developing 1,170 B.H.P. at 375 r.p.m. driving bronze propellers through scoop controlled fluid flywheels and reversing reduction gear boxes. The design to which this remarkable dredger has been built exhibits several unique features and one cannot help but be impressed by the clean layout, smooth operation and flexibility of the machinery installation.



Photograph by courtesy of Messrs. Lobnitz & Co. Ltd.

General Arrangement

The pleasing appearance of " Mersey No. 40 " is shown by our illustration. The vessel has been constructed in accordance with the requirements of Lloyds Register of Shipping for the highest classification of that Authority and the following are leading particulars of the design:

Length overall	263′ 0″
Length between perpendiculars	250′ 0″
Breadth overall	47′ 7″
Breadth moulded	46′ 0″
Depth moulded	19′ 0″
Draft light forward	3′ 2″
Draft light aft	13′ 10″
Draft loaded forward	14′ 5½″
Draft loaded aft	15′ 6″
Displacement loaded	3,675 tons
Hopper capacity	2,000 tons
Service speed loaded	12 knots
Maximum speed light	14½ knots
Engine r.p.m.	375
Crew	17

Features of the profile are a moderately raked stem of round-plate construction; cruiser stern; two-tier deck houses aft, the navigating bridge being approximately amidships. The bridge, it will be noted, is arranged at a level which affords a wide view for navigation and for the control of dredging and loading operations. The midship portion of the hull is occupied by the hopper and wing buoyancy spaces, the hopper sides being sloped inwards to allow easy flow of the spoil to the hopper doors in the bottom of the vessel. The hopper is spanned by a deep longitudinal girder which carries the door-operating mechanism.

Grid plates are fitted over the hopper to retain large stones, ropes and other bulky debris discharged by the grabs, and which might damage the doors should they find their way into the hopper, thus only comparatively reasonable size spoil has to pass through the doors during the discharging operations. The dredging cranes being placed two port and two starboard amidships, can discharge either forward or aft, thus giving a complete coverage of the hopper and enabling loading to be carried out to the required trim.

The hopper doors, six in number, are hinged at the hopper sides and are controlled by hydraulic rams, one ram for each pair of doors. The rams are capable of sustaining the full load but the cotter system is used to avoid the necessity of hydraulic pressure being applied continuously. The doors are of robust all-steel construction and being hollow they are partially buoyant, a feature which assists the retention of the dredgings. The hydraulic cylinders have been designed to withstand a working pressure of 1,000 lb. per square inch.

Dredging Cranes

The main items of the deck machinery are the four electrically-driven grab dredging cranes of the fixed jib type, having a working radius of 20-ft. All four cranes are capable of a dredging depth of 55-ft. below water and each grab has a capacity of 85 cu. ft. representing a gross load (including the grab) of 7 tons. The weight of the spoil handled per lift by each grab is approximately 4 tons. Each crane is powered by a hoisting motor capable of developing up to 99 h.p. and a slewing motor having a peak of 30 h.p.

The drivers are positioned well forward on the superstructure on raised platforms in separate compartments giving them an uninterrupted view of the work, and electric heaters are provided to ensure their comfort under winter conditions.

During trials the hopper of 2,000 tons capacity was filled in under 2 hours.

It is estimated that this new grab hopper dredger will be capable of dredging from the Liverpool Docks over ¾ million tons annually and when it is borne in mind that the spoil is deposited some 15 miles from the Docks this is no small achievement.

The Dock & Harbour Authority

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No. 445

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Editorial Comments

The Ports of Poland

As our leading article this month we are publishing a description of post-war development in the main Polish ports. The author reviews some of the problems which have characterised the growth and modernisation of the ports since the Second World War, and calls attention to the fact that the fundamental problems which have had to be faced are those most closely linked with the economic, social and political changes which have taken place in Poland during the last decade.

The emphasis throughout is placed on the need to increase the export trade and to maintain and further develop the handling facilities for the transit trade. This aim has been pursued not only in the ports themselves but by the country as a whole in its economic approach to the problem of ensuring a more favourable balance of trade, so that in every port there is evidence of concentration on satisfying the immediate demands of overseas trade to the neglect of home requirements. In consequence there is still a pressing need for extensive dredging programmes to be undertaken and for harbour craft such as tugs and lighters to be supplied.

In this connection, it is interesting to note that an agreement has been reached between the Polish Minister of Shipping and the Minister of Heavy Industry (the latter being responsible for the shipyards) to the effect that in future Polish shipyards will deliver a larger share of their output to the home market. In the next two or three years it is hoped to supply over 100 small vessels, totalling some 270,000 tons d.w., including three tugs of 600 h.p. each, and construction will also commence on a motor tanker of 18,000 tons d.w. During the 1960's still more building is planned for the Polish merchant fleet, including motor tankers, tramps, general cargo carriers, fishing trawlers and ice-breakers. At the same time, some exports of Polish built vessels will be maintained.

Considering the great handicaps which the Port Authorities of Gdansk, Gdynia and Szczecin have had to be overcome and, in view of the difficulties they are still experiencing, our readers will be impressed by the amount of progress which has already been achieved.

O.E.E.C. Conference on Port Working

It appears that a new approach to port working was to be detected at the conference on port productivity, organised by the European Productivity Agency of the Organisation for European Economic Co-operation, which was held in Copenhagen early last month. Delegates representing dock workers of twelve European countries discussed papers relating to the economic aspect of the turn-round of ships, working methods of the port industry, vocational training for dock workers and the social benefits of productivity. Obviously there was a bias towards the labour aspect but throughout the discussions there was an evident awareness of the need to expedite ships' turn-round and of a greater readiness to co-operate with employers in finding the best ways to increase efficiency—a trend which has not previously been evidenced by dock labour organisations in their approach to port problems of vital concern to both sides of the industry. In addition it was stated that wages and any further increases in wages should be related to productivity.

This new attitude on the part of international trade unionism was indicated in the agreed statement issued after the conference. One of the most remarkable comments contained in this statement, extracts of which will be found on a following page, is to the effect that reasonable efforts on the part of dock labour to improve their performance and thereby their earnings should not be impeded by the failure of management to provide them with the most modern machinery and the most efficient form of planning and layout. This is in startling variance to the traditional policy followed by dock labour organisations. Hitherto, port workers in all parts of the world have been strongly opposed to the introduction of mechanised equipment on the grounds that redundancy and unemployment would result. It would seem that they have now begun to realise that the more efficient a port is and the quicker the turn-round of ships can be effected, the greater prosperity will result for all concerned.

Port Talbot Docks

Concluding our series of articles describing the Ports of South Wales, we are publishing this month a description of Port Talbot. In common with the other four ports comprising the group controlled by the British Transport Commission, Port Talbot owes its growth to coal mining and the manufacture of iron and steel, and it is the latter industry that dominates its trade to-day.

In close proximity lies the immense undertaking of the Steel Company of Wales, which is the largest and the most up-to-date plant in Europe for the manufacture of steel. In order to handle an ultimate importation of iron ore of some 3½ million tons a year, the port has extended the Margam Wharf which has also been equipped with four modern transporter grabs and a conveyor system which links the ore ships to the stockpile or main works. It is worthy of note that by means of this equipment a speed of discharge of 1,000 tons of ore per hour has been achieved. Nor should it be overlooked when considering the traffic of the port that, although the import of ore comprises the main trade, there is an increasing export of steel sheets.

These recent developments have already improved the industrial turnover of the area and also increased the tonnages handled by the port, and under vigorous management Port Talbot should be assured of greater prosperity in the years to come.

Traffic Through British Ports

When the factors influencing the flow of traffic through British ports were discussed last month at the annual conference of the Institute of Traffic Administration, attention was concentrated in the main on dock charges, the attitude of dock labour and the growing tendency to transport in containers, in loaded lorries and in bulk. Speed of ship turn-round was also considered, mainly in connection with the possibility of introducing shift work. The facilities a port provides were mentioned but might have been worth considering in greater detail. In these days when package by package handling is giving way to load handling and ships with awkward " manual " stowages are being superseded by vessels designed for mechanical stowing, the facilities available and methods adopted are increasingly important.

The shift system was mentioned by several speakers at the conference which is reported on page 254 of this issue. In a country where there is already full employment, the introduction of shift work in any large industry would have to be carefully planned. Before even a two-shift system could be introduced into port operating work, the serious delays and the damaging

Editorial Comments—continued

waste of man hours which result from abuse of the present labour arrangements would have to be eliminated to release men to make up the second shift. This, it is believed, could only be achieved after a fundamental change had been made in the National Dock Labour Scheme to give port operators some real authority over the labour they employ.

Modernising With Prudence

The chairman of the Mersey Docks and Harbour Board, Mr. M. Arnet Robinson, has recently returned from a fact-finding trip concerning port operation and administration to North America, which included the Ports of Montreal, Toronto and New York in his itinery and involved a journey totalling 8,000 miles. He found both in America and Canada a willingness to discuss port problems with complete frankness and candour, all the information he required being readily put at his disposal. In New York he was able to obtain a complete picture of the working of the port, being provided with the use of a helicopter and a tug. He was impressed by the greater use being made of modern mechanical devices across the Atlantic, but found that port authorities do not generally provide shore cranes for cargoes as in Europe; they do not consider this their responsibility.

Where modernisation and re-equipment take place, the work is done with prudence. For example, the port authorities do not rush to put up new sheds without carefully assessing the need for them, and when they build they do not go in for the solid structures favoured in Europe, although the sheds they provide are well-designed and thoroughly efficient.

Mr. Robinson also visited the site of the St. Lawrence Seaway and found divergent opinions as to the effect of the project on shipping between Europe and America. The fact that ocean-going ships will be able to get up to the Great Lakes is bound to have a marked influence on trade and he believes that eventually some shipowners will build a special type of ship for this purpose. The closing of the Seaway for four months in the year because of ice complicates the economics of the problem. A few enthusiastic people were encountered who believe that modern science will overcome the ice problem, but they were in a minority.

Topical Notes

Iron Ore Import to Tyne Dock. Record Cargo.

The dual-purpose bulk cargo carrier "Ruth Lake" docked at the iron ore quay of the Tyne Improvement Commission, Tyne Dock, on the 11th November with 29,000 tons of Labrador ore aboard. This cargo is the largest single ore import, not only for the Tyne but for Great Britain, and was to have been delivered by the "Sept Iles," a sister ship. However, the "Sept Iles" has suffered a minor collision in the St. Lawrence River and is now remaining on the other side of the Atlantic for repairs.

The "Ruth Lake" has gross and net registered tonnages of 21,157 and 11,783 and has a summer deadweight of 31,000 tons. Her principal dimensions are 661-ft. 8-in. by 87-ft. 5-in. beam, with a summer loaded draught of over 34-ft. Her draught on arrival at the Tyne was 33-ft. 8-in. and it was necessary for the Commissioners to dredge the reception berth to 36-ft. below L.W.O.S.T. to accommodate this and other carriers of the largest class.

B.T.C. Improvements for Southampton and Hartlepools.

The British Transport Commission have authorised improvement schemes at their Southampton and Hartlepools docks at estimated costs of £410,000 and £564,750 respectively.

The Southampton scheme provides for ten new electric quay cranes—nine for the New Docks and one of the Ocean Dock—to enable traffic now being imported and exported through the port to be handled more efficiently. Five of the cranes will be of 6/3-ton capacity and five of 3-ton, all with a working radius of 86-ft. Improvements at No. 25 Berth, Empress Dock, at which banana traffic is discharged by a system of elevators and conveyors, will include the reconstruction of two bays in the transit shed, re-alignment of railway tracks, and improved facilities for the reception of passengers.

At Hartlepools "A" and "C" Jetties at Union Dock, which handles the bulk of the timber imported through the port, will be equipped with twelve new electric level-luffing cranes with a radius of 65-ft. Two will be of 10/3-ton capacity and ten of 3-ton. The quays on the jetties will be paved flush in concrete, new crane tracks will be laid and railway lines re-positioned. The west wall of Middleton Passage, the navigable channel between Central and Union Docks, will be re-built in steel-sheet piling, and the width of the channel increased by 10-ft. to 67½-ft.

New Port Facilities in the Bay of Plenty, New Zealand

Following the establishment of a new £30 million pulp and paper industry on New Zealand's North Island, further industrialisation and the construction of port facilities are rapidly taking place at Mount Maunganui, on the Bay of Plenty, which is one of the Dominion's leading seaside resorts.

Although a new port has already been built at Mount Maunganui to handle the cut timber and paper and pulp products which are brought from the Kawerau mill by a specially built railway, the present wharf facilities are insufficient to handle the increase in the number of ships using the port and a 175-ft. wharf extension is to be built. The new section will be a little wider than the existing wharf and will enable three inter-colonial ships and a large tanker to berth simultaneously. Railway marshalling yards are being built at the junction of the wharf to facilitate the turn-round of wagons.

At the southern end of the new Mount Maunganui wharf a 130-acre area of waste land is being converted into an industrial site. One of the largest structures so far erected is a £1,250,000 fertiliser works which was due for completion in August last for the Bay of Plenty Co-operative Fertiliser Company. Here, a 330-ft. long, 50-ft. high materials store will house 12,000 tons of rock phosphate and 5,000 tons of sulphur, all of which will be unloaded from sea transport at the new Wharf, about three-quarters of a mile away. A large superphosphate store will house the finished product.

Public Corporation for Port of Colombo.

The Ceylon Government announced last month their decision to set up a corporation to operate the commercial port of Colombo. This step marks yet another attempt to find a satisfactory method of running the port efficiently and is the sequel to the report of the commission of inquiry, details of which were given in the March, 1957, issue of this Journal.

It is now proposed that the Government of Ceylon will hold 75 per cent. of the shares of the new corporation, and the balance of 25 per cent. will be allocated among land and stevedoring companies, provided they are operated by Ceylonese nationals. If at any time after the establishment of the corporation the companies wish to withdraw their holdings, they will have the right to sell their shares, but only to the Government. The highest priority will now be given to the drafting of the necessary legislation to implement the decision and the financial implications will be examined by a special departmental committee appointed for the purpose.

The Government of Ceylon has also decided to set up a joint port consultative council on the lines of British joint industrial councils. This will consist of an equal number of workers' and employers' representatives whose main task will be to regulate labour relations. A welfare association for port workers is also to be established.

Although these decisions have been generally welcomed in Ceylon, both Mr. P. Gunawardene, Minister of Food and Agriculture and leader of the Harbour and Dock Workers' Union, and Dr. M. N. Perara, leader of the Parliamentary Opposition and leader of the United Port Workers' Union still hold the view that the only remedy for the constant dislocation of the port's working is nationalisation.

The Ports of Poland

Post-War Organisation and Economic Problems

By T. SZCZEPANIAK (Lecturer in Port Economics, Sopot)

IT is not an easy matter to present, in an article of limited length, a full and comprehensive account of all the changes that have taken place in the post-war development of the Ports of Poland. The difficulty is all the greater inasmuch as the problems that are considered serious in Polish ports have no equivalent ones in other countries, so that the changes that have taken place in Poland are not exactly comparable to those occurring elsewhere.

Readers have already had an opportunity of acquainting themselves with the development problems of Polish ports, particularly with reference to those problems connected with their reconstruction, from an article on the subject which appeared in the January, 1950, issue of the "Dock and Harbour Authority."

The Composition of Goods and Volume of Port Turnover.

The post-war economic development of Poland is characterised by its rapid rate of industrialisation, particularly in the years 1949-1955. This fact had a great influence both on the composition of the goods and the size of the foreign trade; and, consequently, on the turnover of the Polish ports. Their participation in the production of foreign trade amounted to one-third of the total value.

The changes in the composition of Polish foreign trade, which have been conditioned by the economic transformation of the country, are expressed in the first place by the increased export of industrial goods and by the limitation of exports of raw materials with a simultaneous increase in the import of these materials into the country. This tendency to expansion in foreign trade has been reflected in the goods turnover of the ports, in the rapid increase of general cargo transhipment, in the gradual decrease of coal exports and in an increase in the import of ores and other bulk cargoes.

The following table shows the composition and volume of goods turnover in the three principal ports.

It is worth noting from these figures the twofold increase in the total general cargo turnover that took place in the 1949-1955 period. It should be mentioned that the exports of machinery, of complete industrial plants, and of other products of the heavy engineering industry increased particularly. The decrease in coal exports which occurred in this period in spite of the continual increase in coal production is accounted for by the increased demand in the home industry. The export of coal in 1956, which has not been included in the table, shows a further drop to a little over 7 million tons. Apart from ores the import of other bulk cargoes, including mainly phosphates, phosphorites and liquid fuel, increased rapidly.

When drawing an outline of the total goods turnover during the last few years it should be pointed out that no remarkable increase of total tonnage has taken place but the systematic improvement in the value of the goods handled has been going on steadily.

Small ports such as Darlowo, Ustka and Kolobrzeg were utilised as commercial ports in the early post-war years, but since 1951 they have become entirely fishing ports and the main cargo mass is divided between the three ports of Gdansk, Gdynia and Szczecin. A certain specialisation is apparent although all three ports are universal ones; the handling of general cargo is chiefly concentrated in the Port of Gdynia whereas in Szczecin and Gdansk there is a notable predominance of bulk cargoes as compared with other kinds of cargo. However, in both these ports the general cargo turnover indicates a tendency to increase.

The handling of coal is being drawn away from Gdynia and both coal and ore operations are gradually concentrating on Szczecin. This is due chiefly to the convenient navigational route for both these cargoes along the Odra River, which connects the port with the Silesian Coal Basin, which is at the same time an important centre of the smelting industry.

The percentage of general and bulk cargoes handled at the three ports during 1955 was as follows:

	General Cargo	Bulk Cargo
Gdynia	52%	24%
Gdansk	26%	32%
Szczecin	22%	44%

Transit Trade.

Owing to their geographical situation and convenient communication system with the countries of Middle Europe, the Polish ports also handle a considerable amount of transit cargo, the volume of which is steadily increasing, as can be seen from the following figures:

Year	Percentage of total turnover.	Percentage excluding coal and coke.
1938	9.8%	25.6%
1951	9.9%	29.4%
1955	16.4%	31.8%

The total volume of transit turnover during the years 1949-1955 amounted to:

1949—1,226,300 tons	1952—1,502,800 tons
1950—1,582,800 tons	1953—1,778,900 tons
1951—1,462,700 tons	1954—2,596,100 tons
1955—2,640,000	

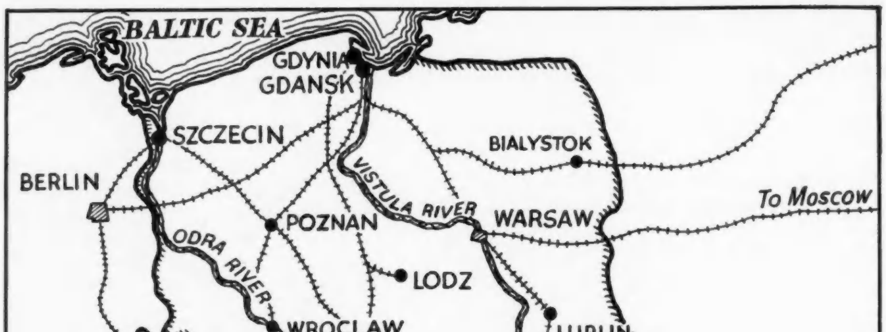
This rapid growth of the transit turnover, especially for the years 1954 and 1955, is due to the favourable development of trade between the European socialist countries and the Chinese People's Republic. Owing

CARGO TRAFFIC AT POLISH PORTS (in 1,000 tons)

	1937	1949	1953	1954	1955	% 1949-1955
Port of Gdynia						
Coal and Coke ...	6,407	3,508	1,989	2,058	1,986	57
Ores	198	606	485	620	482	82
Grain	—	313	67	355	412	132
Wood	251	192	45	94	86	45
Other Bulk Cargo ...	888	117	201	256	291	249
General Cargo ...	1,262	944	1,301	1,415	1,793	190
Total Turnover ...	9,006	5,680	4,088	4,798	5,050	89
Port of Gdansk						
Coal and Coke ...	3,734	4,714	2,230	2,388	2,654	56
Ores	1,062	509	646	878	794	156
Grain	279	287	78	232	302	105
Wood	1,181	84	149	117	211	251
Other Bulk Cargo ...	174	334	188	335	406	122
General Cargo ...	771	439	662	745	877	200
Total Turnover ...	7,201	6,367	3,953	4,695	5,244	82
*Port of Szczecin**						
Coal and Coke ...	—	3,319	3,269	3,092	3,404	103
Ores	—	506	828	944	843	167
Grain	—	204	274	422	332	163
Wood	—	53	122	233	209	394
Other Bulk Cargo ...	—	137	963	1,058	1,220	891
General Cargo ...	—	251	461	531	764	304
Total Turnover ...	8,331	4,470	5,917	6,280	6,772	151
Total of the Three Ports						
Coal and Coke ...	—	11,541	7,488	7,538	8,044	68
Ores	—	1,621	1,959	2,442	2,119	131
Grain	—	804	419	1,009	1,046	126
Wood	—	329	316	444	506	154
Other Bulk Cargo ...	—	588	1,352	1,649	1,917	326
General Cargo ...	—	1,634	2,424	2,691	3,434	210
Total Turnover Volume	—	16,517	13,958	15,773	17,066	103

* Before the Second World War Szczecin was part of Germany and was known as Stettin.

The Ports of Poland—*continued*



Important communication routes connecting Polish ports with the hinterland.

to the fact that the Polish Merchant Navy was the first in Europe to establish a regular shipping service with China, the ports of Gdynia and Gdansk became the basic ports for the Chinese line.

The main countries trading through the Polish ports are Czechoslovakia, Hungary and the East German Republic. Details of their participation in the transit trade of Poland are as follows:

Year	Czechoslovakia.	Germany.	Hungary.	Sea transit/ tranship- ment.	Other Coun- tries
1951	83.2%	10.5%	4.3%	1.8%	0.2%
1953	43.6%	20.6%	14.3%	17.8%	3,7%
1954	53.9%	20.0%	21.4%	3.5%	1.2%
1955	59.8%	17.0%	15.0%	6.7%	1.5%

Bulk cargoes were directed mainly to Szczecin and Gdansk and general cargo was concentrated chiefly in Gdynia. The exact volume of transit goods passing through the particular ports amounted to:

Year	Szczecin	Gdynia	Gdansk
	Tons	Tons	Tons
1947	37,000	375,500	405,200
1951	539,800	533,800	389,100
1954	1,244,000	686,000	665,700
1955	1,278,600	742,600	618,800

The problem of maintaining and still further developing the ports to cope with the transit trade is at present one of the most urgent tasks with which the Port Authorities have to deal. They are aware that in many cases the directing of transit shipments through Polish ports was prompted in the first place by political reasons, and this was not always remunerative from the commercial point of view. The relaxing of tension in international relations, the favourable development of economic relations between the East and West, the revival of friendly relations between Jugoslavia and other socialist countries have all contributed to the fact that competition with the ports of Hamburg, Rijeka and Trieste is now being felt more acutely by the Polish ports so that they are obliged to reconsider all the economic factors regarding the transit policy so that losses may be avoided.

The Lay-Out and Technical Equipment of the Ports.

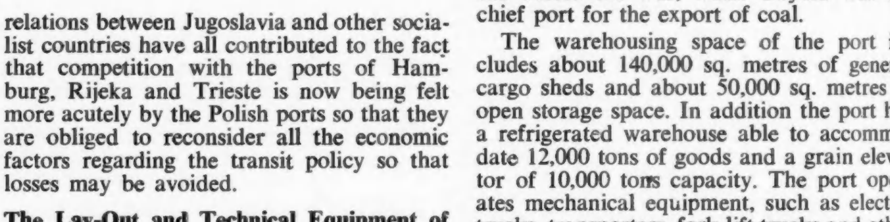
There were few ports in Europe that suffered greater destruction during the recent war than the Polish ports, especially the port of Gdynia. The work of reconstruction which took place under very difficult economic conditions—because of the devastation in every other field of national economy—was practically completed in 1950. In the following six years all the financial resources available were mostly devoted to equipping the ports with modern cargo handling appliances, to suit the needs of the changing structure of shipments handled.

The actual lay outs and technical arrangements of the ports are as follows:

The Port of Gdynia.

This is a modern artificial port, protected from the open sea by the Hel Peninsula, which has basins 36-ft. deep enabling it to handle the largest Baltic going ships. The total length of the quays amounts to over 10 km., of which 6.6 km. comprise the commercial port, the remainder serving the needs of the deep-sea fisheries and the shipyard. The quays are equipped with portal cranes and semi-portal cranes of 1.5 to 7.5 tons lifting capacity as well as bridge cranes of 15 tons lifting capacity. The port also operates three floating cranes, each having a lifting capacity of up to 100 tons. There are several mobile cranes and two belt conveyors for the loading of coal; their output is up to 500 tons per hour. These conveyors were in use before the war, when Gdynia was the chief port for the export of coal.

The warehousing space of the port includes about 140,000 sq. metres of general cargo sheds and about 50,000 sq. metres of open storage space. In addition the port has a refrigerated warehouse able to accommodate 12,000 tons of goods and a grain elevator of 10,000 tons capacity. The port operates mechanical equipment, such as electric trucks, transporters, fork-lift trucks and other appliances needed for the handling of cargo, both in the warehouses and on the quays. The railway system contributes considerably



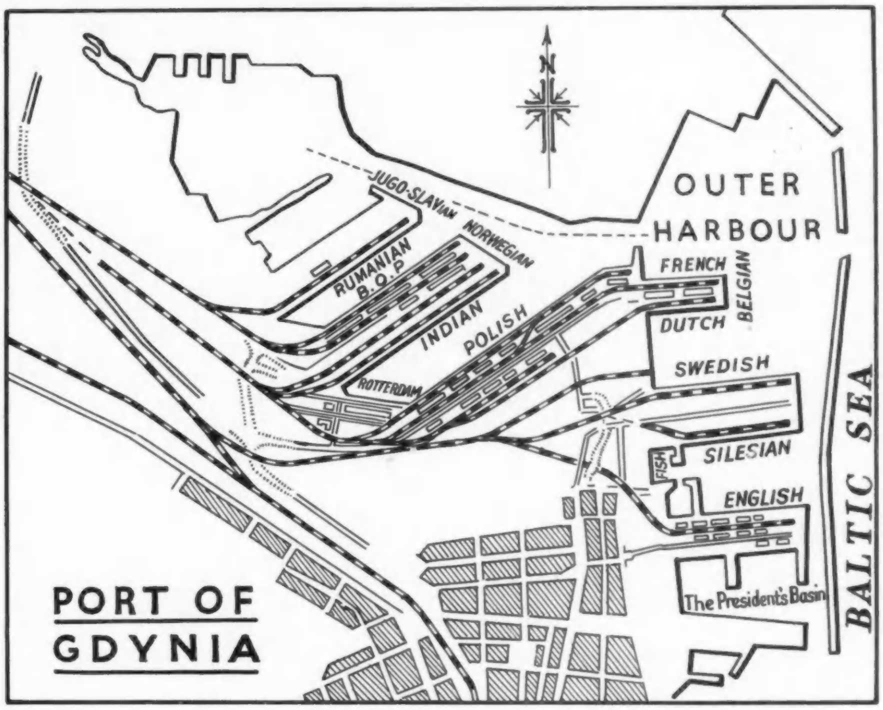
General view of the basin in the port of Gdynia with ships moored along the Polish Quay.

The Ports of Poland—continued

to the efficient handling of cargo and serves every berth by means of at least two lines running the length of the quay.

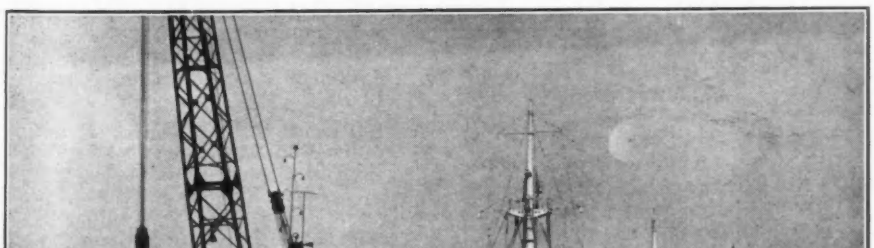
The Port of Gdansk.

The basins and quays of Gdansk are situated along the old, and at present, dead mouth of the Vistula. The quays have a total length of over 5,000 metres and can accommodate ships having a draught of up to 29-ft. The equipment of the port includes portal cranes of 3 to 7.5 tons lifting capacity, bridge cranes of 10 to 15 tons lifting capacity, two floating cranes and three belt conveyors for the transhipment of coal. Warehouse accommodation covers an area of 64,000 sq. metres and the open storage space has an area of 210,000 sq. metres; there is also a grain elevator with a capacity of 15,000 tons. The port has sufficient mechanical equipment, floating craft and transport units for the needs of the inner port. In spite of the fact that Gdansk is connected with the hinterland by means of the Vistula waterway the river barge traffic is insignificant owing to the inadequate depth of the river bed and the railway is the main means of communication with the port. After realisation of the project already planned, the obstacles at present encountered during the passage of larger vessels, owing to the narrowness of the port canal and also the so called "Turn of 5 Whistles," will be removed, as the project provides for increasing the width of the canal and also straightening the turn itself.



The Port of Szczecin.

The river and sea port of Szczecin is situated 65 km. from the open sea and its harbour and port area is particularly extensive. The depths of the basins, which vary from 18 to 30-ft., are subject to the waterway connecting the port area with the sea. The depth of this waterway does not exceed 30-ft. so that ships bound for the central port with a greater draught are obliged to tranship part of their cargo in the bunker and lighterage basin of the Szczecin port at Swinoujscie. The 17 quays which are used have a total length of over 7.5 km. The equipment of the port, which is mainly designed for handling bulk cargo, includes portal and bridge cranes, a large belt conveyor for coal with a capacity of 30 to 100 tons. The storage arrangements of the port comprise 140,000 sq. metres of storage area, 26,000 sq. metres of warehouses and one of the largest grain elevators in Europe with a capacity of 50,000 tons. The Odra River is very important as a route connecting the port with the hinterland, especially for the transport of bulk cargo. Owing to the vast area of the port which is divided by numerous canals, the lay-out of the port railway system is inconvenient.

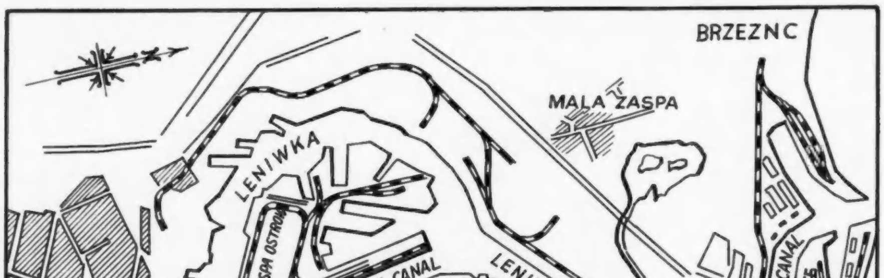


M.S. "Warynski" awaiting loading of lorries by 60 ton capacity floating crane.

When estimating the actual technical level and especially the cargo handling potential of the ports, the great progress that has taken place in the last few years is noteworthy. This is particularly obvious in the field of modern mechanical cargo handling equipment, which facilitates all forms of cargo movement on the quays, in the ship's holds and the warehouses. The use of equipment such as electric trucks, fork-lift trucks, transporters and mechanical stowing and trimming appliances—of which there were none in the pre-war and early post-war years—is progressively eliminating the heavy manual work of the dockers. Pallets, the number of which runs into several thousands in the port of Gdynia, are also being used more extensively.

However, the changes in the methods of cargo handling which are taking place elsewhere, as well as the further changes which are foreseen, together with the increasing competition being experienced from the ports of West Europe and the Northern Adriatic coast emphasise the extremely important tasks which cannot be neglected in the field of further equipment at the ports. These tasks have been outlined in the Five Year Port Development Plan which covers the years 1956-1960. The main projects in

The Ports of Poland—continued



regards to the maritime commercial ports are:

(1) Further equipping the ports with modern cranes of home and foreign manufacture;
(2) Building new warehouses with a total floor space of 25,000 sq. metres;
(3) Increasing the complement of port floating craft, especially tug-boats, lighters and pontoons;
(4) Constructing new storage areas and reconstructing roads and tracks to facilitate the free movement of mechanical equipment;
(5) Dredging port canals and basins, especially in Gdansk and Szczecin;
(6) Purchasing many types of modern mechanical handling equipment;
(7) Constructing a special area for handling transit cargoes in the port of Szczecin.

The realisation of these projects will greatly help the Polish ports to take their place among the leading ports of Europe in regard to technical equipment.

Port Services.

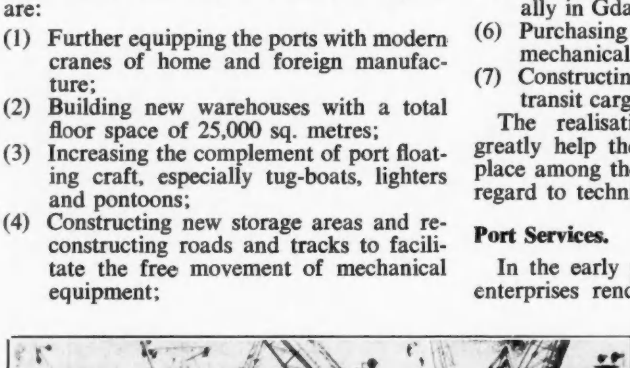
In the early post-war years a number of enterprises rendering various services were established, and several continued the work they had done before the war. Some were private, some co-operative, and others state-owned.

The changes in this field, which took place between 1945 and 1951, were (1) the concentration in a given port of a particular group of services into one separate enterprise, thus gradually liquidating numerous stevedoring, forwarding, brokerage and ship chandling enterprises; (2) the replacement of private capital by state capital.

As a result of this transformation the structure of port administration is largely different from that abroad. Instead of numerous competitive enterprises of the same kind there is, as a rule, only one organisation which constitutes the backbone of the productive activity of the port, all work being executed exclusively by the Port Authority which is an independent state enterprise and manages the whole water and port area. Apart from conservation and maintaining of the port, the Port Authority (separate units in Gdynia, Gdansk and Szczecin) renders the following services: transhipment, stowage, trimming, storage, cargo handling, pilotage and mooring. Owing to the amalgamation of capital consuming activities, such as research and conservattion, with such profitable services as the handling of cargo and ships, a realistic foundation has been created for the Port Authorities, not only for their financial self-sufficiency but also for profit making.

The forwarding of cargo is operated by " C. Hartwig," a separate enterprise (not rendering any other service), which executes the forwarding of all cargo passing through a given port with the exception of the Czechoslovak transit. This is operated by " Spedrapid," a mixed Polish-Czechoslovakian firm.

The supervising and control of cargo is concentrated in " Polcargo," which has a



Loading mixed cargo on the M.S. " Edward Dembowski."

Semi portal cranes installed at Gdynia.

The Ports of Poland—continued

branch in every port, and there is also a Swiss firm, " Supervise," working in a similar capacity.

The " Morska Agencja " are brokers agents for all foreign ships. This organisation has its offices in Gdynia, Gdansk and Szczecin.

The ships are provisioned by " Baltona," ship chandlers agents, which has posts in all three ports. " Baltona " supplies both provisions and technical as well as industrial articles.

Labour.

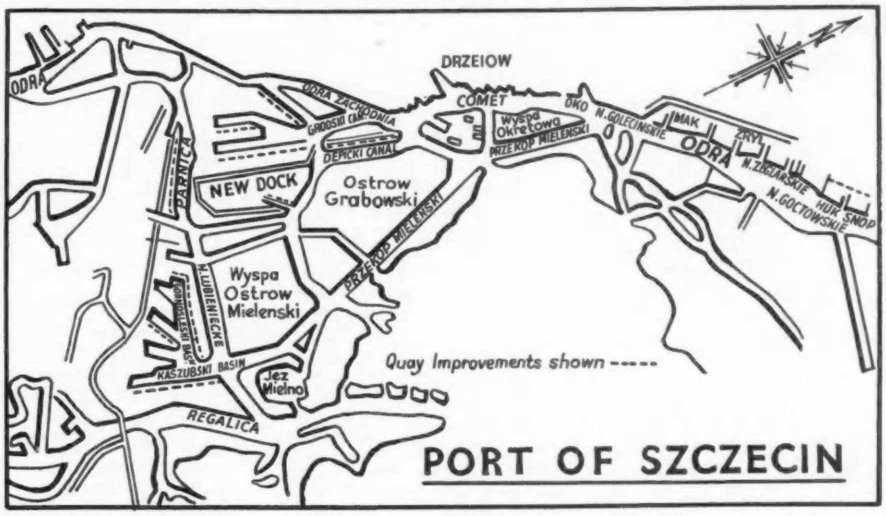
Concurrent with the changes in the principal port services, changes have taken place in the conditions affecting the employment of port workers. The problem of a permanent or casual worker, which is being widely discussed in foreign ports, has been solved in the Polish ports in a manner convenient for both the employer and the employee. The port workers are employed permanently and there are no institutions in the Polish ports such as the National Dock Labour Board in the United Kingdom or similar organisations in other countries. The economy of such a solution to the problem depended to a large extent upon the existence of only one enterprise in every port (the Port Authority) employing several thousands of port workers.

The number of workers to be employed in every port is calculated on the basis of the average demand for working power backed by the mean volume of port traffic. A certain reserve of labour is taken into consideration for covering any additional demands such as peak traffic. The workers are obliged to come to work regularly, but in those cases where there is a decrease in demand for dock labour the surplus hands are employed for the slack period by the organisation called "Zaklad Robot Zastepczych " (Enterprise of Substitute Jobs). This is a separate enterprise, directed by the Port Authority, which mainly produces reinforced concrete building material. Apart from employing these hands, the enterprise, having a certain number of its own permanent workers, is able to supply reserve working power in the peak traffic periods in the port. This is the principal method introduced by the Port Authorities to solve the contradictions arising from permanent employment on the one hand and casual working on the other. In addition to the foregoing scheme the Port Authorities also enter into periodical agreements with some of the enterprises in the towns for the hire of labour whenever the need arises.

The workers who are permanently employed are granted paid holidays (from two to four weeks depending upon the nature of their work), receive medical care free of charge, and also benefit from many services and privileges of a social nature stipulated either by national agreements or in the collective agreements concluded between the Trade Unions and employers. The benefits from these agreements include protective clothing, partly paid meals during working hours and the building of tenement houses, gymnasiums and sports grounds. The Port Authorities are also obliged to finance the cultural and recreational activities of the workers.

Shipping Connections of the Polish Ports.

The Polish ports operate three shipping organisations: the " Polish Ocean Lines " in Gdynia, responsible for ocean transport; the " Polish Steamship Co." in Szczecin, which operates the shipping lines within the boundaries of the European ports and " Coastal Shipping " in Gdansk. Gdynia is, in addition to the above, the seat of the joint Chinese/Polish Shipping Company known as the " Chinese-Polish Shipbrokers Co." These Polish shipping enterprises, together with the fleets of foreign ship owners, enable the Polish ports to maintain 93 regular lines to the most important ports throughout the world. The number of regular lines operated by the respective ports are: Gdynia 52, Szczecin 29, Gdansk 12. When speaking of the ocean lines, the services on the Far East and South American lines are of particular frequency. The Port Authorities are endeavouring to further increase the number and frequency of regular shipping connections that would be operated both by foreign and home shipowners. These efforts are being energetically pursued because the Polish ports are anxious to serve the interests of foreign ship-owners in spite of their slightly out-of-the-way situation in relation to the main West European sea routes. Their attractiveness is due to the variety of cargoes and the satisfactory service offered, a special feature being a 3-shift working system and the possibility of transhipping on Sundays and some holidays.



Industry in the Port Towns.

The port towns are included in the post-war industrialisation of the country. When speaking of the industry in these towns we have in mind two main groups of industrial works: (1) the industries linked with the " cultivation of the sea," i.e. the shipyards and fishery industries and (2) the industries depending on imported raw materials or producing goods for export.

In the former sphere the port towns can boast of considerable success. Within the last 11 years the ship yard industry in Gdansk, Gdynia and Szczecin has been rebuilt and developed. The annual production of these yards reached a target of 104,000 BRT in 1956, thus placing Poland in the 9th place in Europe and the 11th in the world when considering total world production. The fish processing industry is distributed along the whole coast but is concentrated for the most part in the region of Gdynia and Szczecin. Its further development depends upon a favourable increase of catches which are expected to rise by 200 per cent. over the 1955 figure and should amount to 200,000 tons yearly.

The development of the industries mentioned in (2) has not been so impressive. The port towns are neither the main suppliers nor receivers of the port shipments, a situation which is comparable to that in other countries. This situation is subject to the many circumstances influencing the principles of state policy in the distribution of home industry. Among the most important industrial plants in which production is based on imported raw materials or which are prepared to produce export goods should be mentioned: iron foundries, fertiliser factories, oil seed processing plants and a factory for the production of sweets and chocolates.

The problem of the localisation of further industrial plants in the port towns, and their economic effectiveness, is at present the subject of researches at a number of institutions.

In conclusion, it is worth calling the attention of the reader to some changes taking place in the operating of the ports, which are a reflection of the changes in the system of directing the national economy as a whole.

Generally speaking, the progress taking place is that of decentralising the managements; increasing the authority and operative independence of the port enterprises and arousing a greater interest among the staff as regards the economic activities of the undertakings. An important part is to be played in this respect by the recently established Workers' Councils, which are representatives of the workers in the various establishments. These Councils, being advisory bodies to the managements, and institutions of social control, have a considerable voice in internal policy and the first results of this new system are encouraging.

St. Lawrence Seaway Tolls

United Kingdom Views on Assessing and Collecting

(By a Special Correspondent)

The St. Lawrence Seaway, that great and imaginative project whose impact on the economy of Canada, the United States and Europe is still unpredictable, is now more than half complete. In her broadcast from Ottawa, the Queen indicated that she will open the Seaway in the spring of 1959.

Shipowners in the United Kingdom are, of course, interested in the construction of this new waterway; many of them are planning direct services from this country to various Great Lake ports. As the scheme has progressed there has been uncertainty about policy, especially in regard to the toll system. There has been a division of opinion as to whether tolls should be very low—or even no tolls at all—or fully economic.

United Kingdom shipowners submitted their views to the Seaway authorities in a memorandum and also in evidence before a committee of inquiry. Those views are summarised in the following paragraphs. It was recognised that the Seaway is in a sense unique and that in determining a tolls structure there was no true precedent for the two Seaway Authorities to follow. United Kingdom shipowners believe that if the full potential of the Seaway as an economic international waterway is to be realised, three cardinal principles should be observed.

(1) There should be no discrimination in the use of the Seaway.
(2) The level of tolls should be such as to encourage traffic.
(3) The method of assessing and collecting tolls should be kept as simple as possible.

When, in June, a meeting took place between officials of the St. Lawrence Seaway Development Corporation and members of the American Users Committee on Tolls, a proposal was put forward on behalf of the Development Corporation that tolls should be based on a combination of the dimensions of the ship (based on its net registered tonnage as shown on its national certificate of registration) and its cargo content. The Users Committee opposed this proposal and suggested instead a toll on the ship assessed simply according to whether it was loaded or in ballast.

In their memorandum, United Kingdom shipowners considered that in the special circumstances of the Seaway a distinction merely between loaded and ballast ships would not be sufficient. In the Panama Canal — and the Suez Canal for that matter—there is no way-port trading of any real account and therefore an arbitrary distinction between loaded and ballast ships is all that is required.

But in the Seaway, where ships may trade in ballast for part of their transit and vary their cargo load between one port and another in the Seaway, an account must, it was submitted, be taken of the actual cargo carried. This is of particular importance to some deep-sea carriers who will, in order to enable them to use the Seaway, have no option but to trade partly loaded.

Both Authorities seem to have accepted the principle that dues should be charged at a reduced rate when only part of the Seaway is used. United Kingdom shipowners fully endorse this principle of "part use, part payment" for both the ship and its cargo. With these considerations in mind, they support the suggestion of the Seaway Authorities that tolls should be assessed in two parts—a minor charge based on the tonnage of the ship and the principal charge levied on the cargo actually carried. It is assumed that the two Authorities will agree together the level of the ship and the cargo tolls and that there will be only one toll on the ship and one on the cargo, payable to a single collecting agency.

The main concern of United Kingdom shipowners is to avoid another special system of tonnage measurement being instituted for the levying of tolls on ships. It is admitted that there is at present no universal system of measuring registered tonnage, but experience has shown that port authorities generally accept the net registered tonnage as shown in national certificates of registration for the purpose of levying charges and United Kingdom shipowners suggest a similar acceptance by the Seaway Authorities. If, however, after weighing all the considerations it is felt that a uniform system is desirable, United Kingdom shipowners suggest the adoption of Panama Canal measurement.

They appreciate that different rates for different cargoes may be appropriate, but they urge that any differential should be related only to the nature of the cargo and not to the country of origin or destination. They have been re-assured by a statement made on behalf of the Canadian Authority that the Seaway toll policy under the legislation of both countries will be free of any form of discrimination as between Canadian, United States, local or overseas traffic.

It has been noted that provision is made in the legislation of both countries for tolls to be fixed at a rate which will cover operating and maintenance costs and provide, in addition, amounts sufficient to amortise the capital costs within a period of 50 years. The unique character of the Seaway is particularly relevant in this connection, because alternative forms of transport are so readily available. The traffic of the Seaway will, therefore be very sensitive both to the level and adjustment of tolls. This is particularly so because of the preponderant volume of low value bulk, which is expected to account for more than 80 per cent. of the total traffic moving through the Seaway.

The memorandum emphasises that the use of the Seaway for the carriage of general, or what has been described as package, cargo would be seriously prejudiced if the level of tolls for that class of commodity were fixed disproportionately high in relation to the tolls for bulk traffic. If the various factor suggested by the two Seaway Authorities are to be taken into account in assessing tolls, it seems to United Kingdom shipowners that the customs manifest is the appropriate document for the provision of evidence as to the cargo actually carried. As a general proposition, it is suggested that the toll charged should be related to the proportion of the total facilities actually used.

If the final capital outlay on the Seaway is to be greatly in excess of that originally estimated, it would appear to United Kingdom shipowners that if amortization is to be attempted in the time specified (50 years) it will be necessary to fix tolls at a rate so high as to discourage traffic rather than encourage it as directed in United States legislation. It appears, therefore, that it is a matter for serious consideration whether an attempt should not be made to amend the legislation by extending the period of amortization.

It is assumed that the Seaway Authorities will determine from time to time the level of the tolls on the ship and cargo respectively in relation to the total revenue required for operating and maintenance expenses and any provision that may be decided on for amortization of capital costs, and that whatever may be the policy adopted for the amortization of the capital expenditure, the relationship between the toll on the ship and the toll on the cargo already indicated by the Authorities will be maintained.

In conclusion, the memorandum says that United Kingdom shipowners have been much encouraged by reports that the two Authorities intend that the Seaway should be open to ships of all flags on equal terms and that whatever basis is chosen for levying tolls on ships the same treatment will be accorded to ships of all nationalities.

New Oil Terminal for Los Angeles

It has recently been announced by the general manager of the Los Angeles Board of Harbour Commissioners that work is shortly to commence on a new marine oil loading terminal that will accommodate the largest tankers. Contracts have already been awarded for the dredging and for the building of a dyke at the pier site. A fairway will be dredged from the breakwater entrance to the dock site on the San Pedro side of the harbour, and it is estimated that some 1,400,000 cu. yds. of spoil will be removed from the outer harbour to form a channel 500-ft. wide and 45-ft. deep with a turning basin 1,200-ft. in diameter in front of the pier. The dyke will subsequently be constructed with the dredged spoil. The contract for the construction of the 900-ft. pier has still to be awarded. There will also be 100-ft. dolphins placed off the pier which will give an overall docking length of 1,100-ft. Pipe and pumping systems together with a tank farm are to be installed and it is hoped that the complete facility will be in operation by 1960.

New Dry Dock at Wallsend

Modern Facilities on North East Coast

By ALASTAIR STORRAR, B.Sc., M.I.C.E.*

THE Dry Dock which has just been built for Messrs. Swan, Hunter & Wigham Richardson Ltd., is the largest yet constructed on the North East Coast and forms an important part of the modernisation scheme now being undertaken in their Shipbuilding and Repair yards.

The decision was taken in 1953 to embark on the construction of this, their fourth Dry Dock, at Wallsend. Messrs. T. F. Burns & Partners were appointed to act as Consulting Engineers, and in 1954 a Contract was awarded to Sir Robert McAlpine & Sons (Newcastle-upon-Tyne) Ltd., who commenced work in May, 1954.

The new Dock is 715-ft. long, 105-ft. wide at the entrance, with a depth of water of 29-ft. over the cill at H.W.O.S.T. It will be capable of docking tankers of 45,000 tons D.W. and Aircraft Carriers of the Hermes' Class with angled deck as well as passenger and cargo vessels. The width at entrance is rather greater than that given by the recommended formula

$$B = \frac{\text{Length} + 30}{10}$$

mentioned in the "Memorandum on Construction and Equipment of Dry Docks," issued by the Institution of Civil Engineers in 1952, and follows the more recent trend of an increase in the ratio of beam to length. At the time the dock was designed, it was capable of docking every ship in the British Merchant Marine except six large passenger liners including the two Queens, but that is now no longer the case because of the recent rapid increase in sizes of tankers. It was, however, the largest dock which could have been built on the site. The dock is equipped with a comprehensive system of services as described later, for the efficient repairs of these large ships.

Site.

The site of the dock is in the heart of an existing Shipbuilding and Repairing Yard, and is immediately upstream of, and at an angle of 25° to No. 3 Dock with which it shares a common roundhead. Considerable ingenuity was necessary in siting the dock between existing buildings, certain of which had to be demolished, and others modified in order to give the best approach from the river. This cramped site made conditions very difficult during the constructional period, but with the re-organisation of the Yard nearing completion adequate working space around the Dock is now available.

The ground for about three quarters of the length of the dock was approximately level, but a bank about 40-ft. high existed at the landward end, and in order to construct the dock and also to provide adequate road and rail access around the head to the remainder of the yard, it was necessary to construct retaining walls out into the bank and also to divert the then existing roads, railways and services around the new dock head.

Bore holes which were sunk before work commenced disclosed very varied strata, with layers if soft clays, silty sands, etc., at varying levels and of varying thicknesses. It was also known that old foundations, jetties and slipways existed on the site, all of which were likely to be potential sources of trouble during construction.

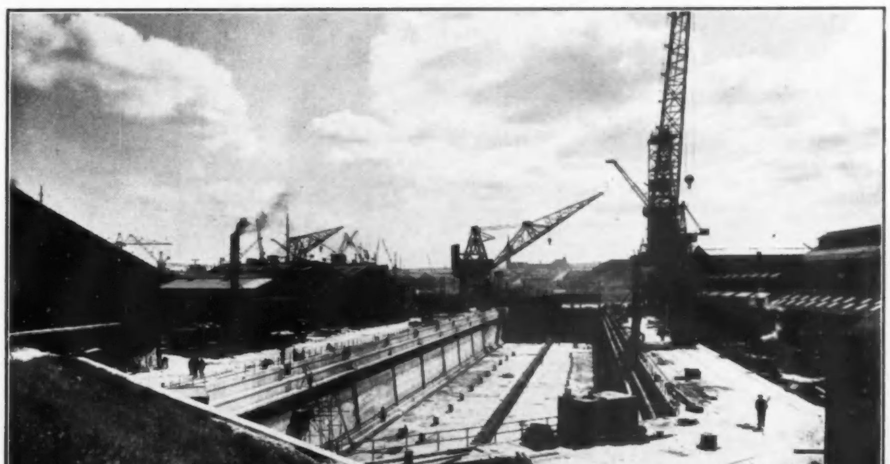
A layer of gravel averaging about 12-ft. thick was overlying the sandstone bedrock and was heavily charged with water. This gravel layer had about 20-ft. of cover of silty sand to the dock formation level and excavation conditions at times became difficult, but were overcome by the deep well system of ground-water lowering, as described later.

Design and Construction.

Various methods of constructing the Dock walls were considered, but in view of the variation in strata likely to be encountered, together with the possibility of ground water in considerable quantity, it was decided by the Engineers to adopt a system of concrete placed in situ. This represents a traditional type of construction except that in order to economise in concrete, high tensile steel reinforcement is used in the back face, which permits consolidated back fill to take the place of concrete over the heel. The walls each have two bilge altars, a top altar and a greenheart faced cantilever altar. The slope of the cope from the entrance to the head is 1 in 200 and this was necessitated by the existing levels at the river end and those of rail tracks at the dockhead.

The walls built in sections each 55-ft. long with 5-ft. contraction gaps thus making units of 60-ft. were constructed within steel sheet piled cofferdams, 60-ft. long x 23-ft. wide. Larssen piles in lengths up to 77-ft. were used to form these cells inside which elevation was carried out by grab, and finally by hand to depth of about 50-ft. These cells, of which there were 25 in number, were heavily framed internally with steel and timber struts and the walls brought up within the piling, the majority of which were later removed.

The entrance of the dock was built in a cofferdam of six cells, which also served to prevent the ingress of water during construction of the dock floor. Two rows of piles parallel to the river front and 32-ft. apart were driven with 5 intermediate diaphragms within which the cill and entrance piers, against which the dock gate closes, were built. The cill is constructed in concrete 18-ft. thick, of which the bottom layer of about 5-ft. was placed under water by diver, necessitated because sheet piles were split and damaged by old foundations. These gave rise to openings through which water and silt flowed, thus making normal concreting in the dry impossible. The piles forming the cofferdam were cut off under water by diver, using oxy-arc equipment



View of dock nearing completion.

* Partner in Messrs. T. F. Burns & Partners.

New Dry Dock at Wallsend—continued

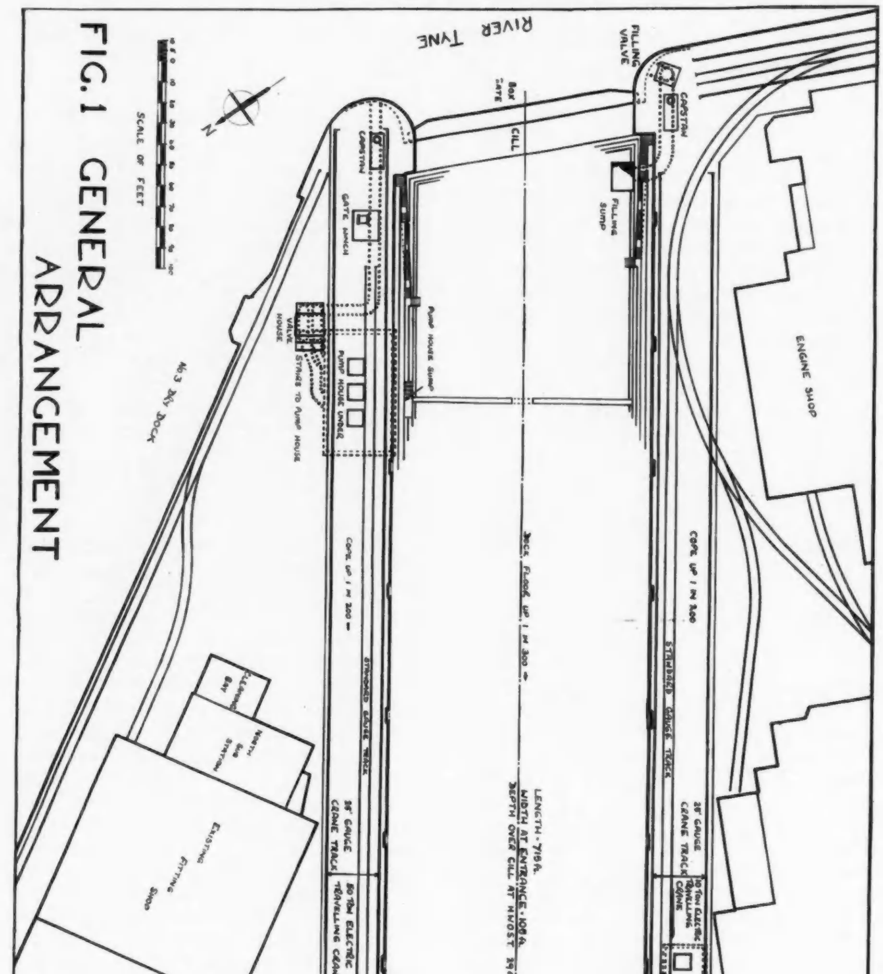


FIG. 1 GENERAL ARRANGEMENT

after the meeting face of the cill and piers had been dressed to sufficient accuracy to make the gate watertight. The meeting face consists of precast granolithic concrete blocks, accurately set in a prepared recess, backed with high grade concrete and finally dressed with carborundum discs to an accuracy considerably better than the ±1/64-in. tolerance specified.

The dock floor is of mass concrete 14-ft. thick at the centre, tapering to 10-ft. thick at the base of the walls, and acting as an inverted arch, resists upward hydrostatic pressure. The floor was concreted in blocks generally in two layers and in strips 20-ft. wide across the dock. Contraction gaps 5-ft. wide were formed in the upper layer which align with those formed in the walls. The floor has a longitudinal gradient of 1 in 300 with a cross fall of 12-in. from the central 10-in. wide strip on which the keel blocks rest. No side drainage channels are provided, only a depression is formed against the lower bilge altar which can thus be easily cleaned.

The construction of the walls followed by the corresponding floor sections proceeded from the head of the dock where conditions were not difficult, but on reaching a point about half-way down the dock it was found impossible to continue ground water lowering using sumps and independent pumps.

Various expedients were attempted to overcome these difficulties without great success, and it was finally decided to instal a system of ground water lowering by pumping from a series of deep wells. The installation and operation of this equipment which consisted of twelve submersible pumps, was entrusted to Soil Mechanics Ltd.

Twelve bore-holes, each about 90-ft. deep were sunk into the layer of gravel previously mentioned—four across the entrance and four on each side of the dock, at about 90-ft. centres. Four-inch bore electrically operated pumps were lowered into the wells thus formed and a total quantity of about 1,000 gallons of water per minute pumped from these was sufficient to lower the water pressure and eliminate "blowing" of the formation. The progress of the work was immediately facilitated, the excavation and concreting being much easier and quicker in dry conditions.

Subway and Services.

A subway is formed within the thickness of the top of the dock walls and runs completely round the dock linking up with a service trench on the existing jetty immediately upstream. The subway is 7-ft. 6-in. wide and 8-ft. high with concrete steps to support the various pipes which include 14-in. ballast (river) water, 6-in. factory water, 5-in. compressed air, 8-in. oil and 2½-in. steam lines.

Liquid oxygen and acetylene pipe lines, are for safety reasons kept outside and are supported from the underside of the cantilever altar.

The services are arranged to emerge from the subway in groups at 60-ft. centres

New Dry Dock at Wallsend—continued

in the construction gaps which were purposely recessed to give protection for the various pipes and valves. On the back wall of the subway are arranged the various cables for supplying power and lighting, both A.C. and D.C. and of various voltages, to the ships in dock, together with copper bus bars carrying D.C. current for welding along the full length of the dock. Arrangements have been made to tap these bus bars at intervals so that welding cables can be led through the subway wall to the ship in dock. These are fed with current from G.E.C. motor generators installed in substations—one on each side of the dock and driven by 5,500 volt A.C. 550 h.p. motors producing up to 4,000 amps at 60—120 volts. Access to the subway and substation is obtained by stairways from the cope. Emergency exits are provided covered by removable timber hatches, and inclined tubes have been cast in the roof in order to allow the passage of long pipes for further services (if required) and for maintenance.

In addition to the service connections at the cope, compressed air and high pressure factory water lines have been provided at bilge altar level as well as oxygen, acetylene and factory water supplies at selected positions.

Dock head under construction.

Filling Valve.

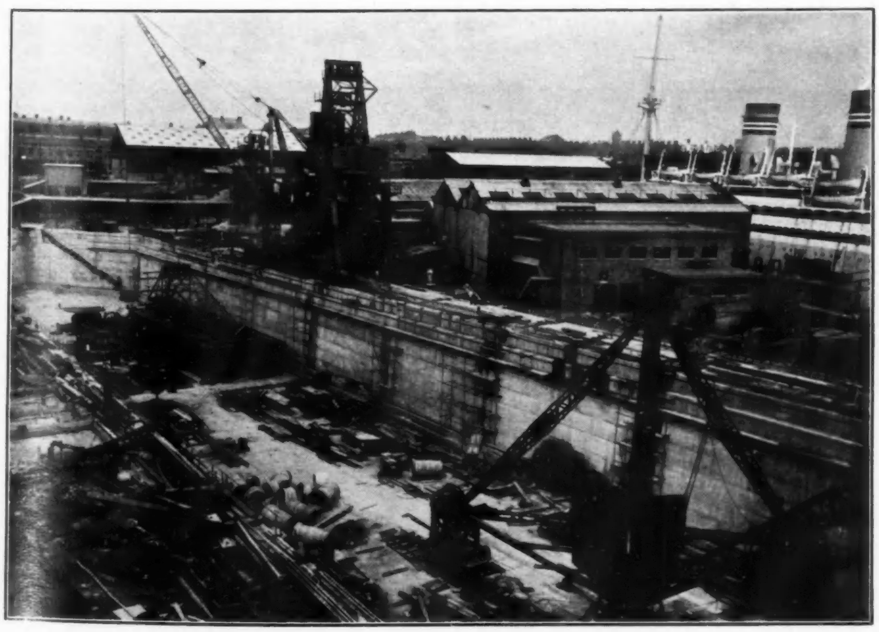
The dock is filled in 2 hours through an equilibrium filling valve situated in a recess in the concrete forming the South Entrance Pier. The valve communicates directly through a 6-ft. dia. concrete culvert with a sump in the dock floor. The valve consists of a 7-ft. 6-in. diameter mild steel cylinder 17-ft. 6-in. long seated on a cast iron taper pipe, topped by a galvanised mild steel angle ring. The water tightness is effected by a rubber ring attached to the base of the cylinder bearing on the galvanised ring. The valve cylinder suitably balanced can be operated by hand through a square thread capstan screw, the full lift of 2-ft. being achieved in two minutes. The lip of the valve is set at 7.15-ft. below O.D. so that filling can be carried out at any state of the tide. The filling valve was constructed and installed by Sir William Arrol & Co. Ltd.

Pumphouse and Pumping Equipment.

The pumphouse with the main drainage sump immediately below is situated about 120-ft. from the dock entrance and is formed by an extension of one of the 60-ft. sections of the dock walls. Its location is not ideal but was dictated largely by the close proximity of the existing No. 3 dock.

It consists of a reinforced concrete structure with walls of 2-ft. in thickness 56-ft. 6-in. long x 29-ft. wide with the sump floor at a level of −30. 33 O.D., the main pump floor at −14.0-ft. O.D. and the roof is at cope level, i.e. +13.O.D. The floor of the sump is 6-ft. 9-in. thick with a sinking at one end for the lower auxiliary drainage pump suction and for the clearance of any necessity silt, the pump floor is 4-ft. thick. The roof is so constructed to allow the dockside crane and the standard gauge track to pass over. Removable panels, asphalted over are arranged to give access to the pumps and motors if replacement of these should be required. No crane is provided in the pumphouse but adequate lifting beams for maintenance purposes have been arranged.

The two main pumps which are arranged in echelon are electrically driven 48-in./44-in. horizontal spindle centrifugal pumps directly coupled to and driven by 5,500 volts 580 b.h.p. slip ring motors with liquid starters. With both pumps in operation the dock has been pumped out from H.W.O.S.T. in 2½ hours, and with a medium sized ship this has been accomplished in 2 hours. The capacity of the dock is 2,500,000 cubic ft. or 72,000 tons; the rating of each pump being 150 tons per minute. In addition to the main pumps there are three 10-in. vertical spindle electrically operated centrifugal pumps, one for drainage, one for ballasting ships in dock, the third may be used for either purpose. These pumps can also be used for jetting



Dock under construction and entrance gate being assembled.

New Dry Dock at Wallsend—continued

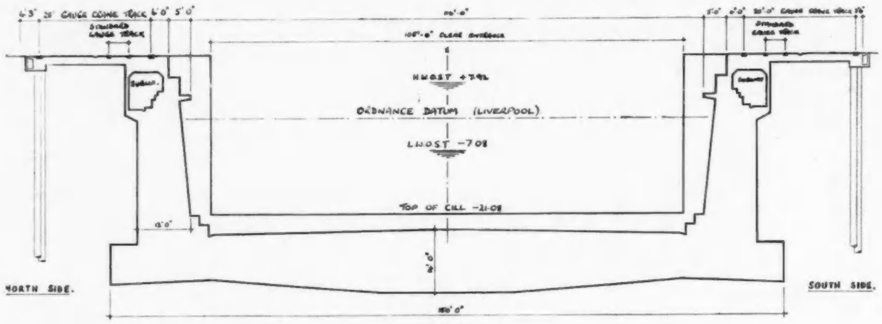


FIG. 2.
TYPICAL CROSS SECTION SHOWING ENTRANCE.
SCALE of FEET.

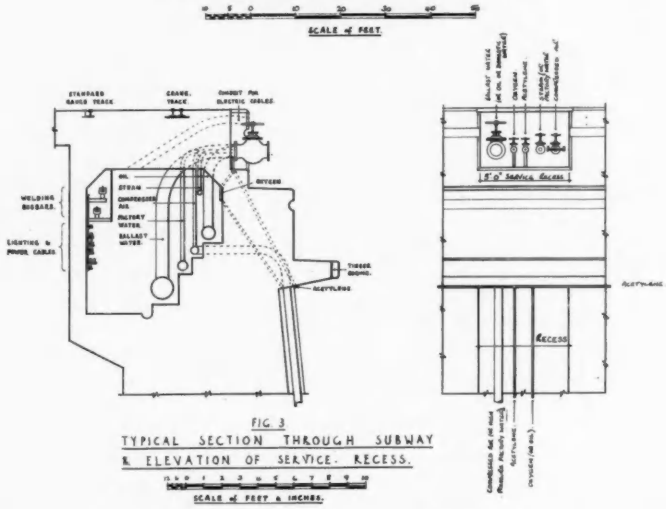


FIG. 3
TYPICAL SECTION THROUGH SUBWAY
& ELEVATION OF SERVICE-RECESS.
SCALE of FEET & INCHES.

silt from the apron on the river side of the dock cill.

A small "Booster" pump to provide high pressure water from the factory supply is also installed for fire fighting.

The discharge from each main pump is led into a reinforced concrete pipe 4-ft. 6-in. in diameter which is constructed in the form of a syphon and surrounded with concrete and finally led to the river within the thickness of the dock wall. The invert of the crest of the syphon is at +12.50 (i.e. above highest known tide level) and a hydraulically operated syphon breaking valve is fixed at the top of each syphon. On starting up a main pump, oil pressure generated from a chain driven pump directly connected to the main pump shaft closes the syphon breaking valve. When the main pump stops the oil pressure drops, thus allowing the syphon breaking air valve to open, and prevents water from the river syphoning back into the dock. The pumping plant was supplied and installed by Messrs. Drysdale & Co. Ltd.

Dock Gate.

The dock gate is of the "Box" flap type hinging down on to the river bed, built and installed by Sir William Arrol & Co. Ltd. It is 111-ft. 4-in. long x 35-ft. deep and 7-ft. 9-in. thick and is of all welded cellular construction weighing 240 tons. It is believed to be the largest of its type yet built.

The structure is divided into separate air and flooding chambers, the buoyancy resulting from the air chambers minimising the pull on the operating rope at the lowest level; flooding holes being arranged on the outer skin to allow the flooding chambers to be fitted as the gate is lowered into the water and drained as the gate is raised.

At the ends of the keel of the gate are welded segmental mild steel trunnions which rest in melchanite cast iron bearings built into the base of the entrance walls.

The gate is operated by an electrically driven winch through a fluid coupling and worm reduction gear which together with the necessary switchgear is contained in a brick building on the North side of the dock. A control pillar with a push button operation is situated immediately adjacent to the entrance and is hinged to lie flush with the cope after operations are completed.

Cranes.

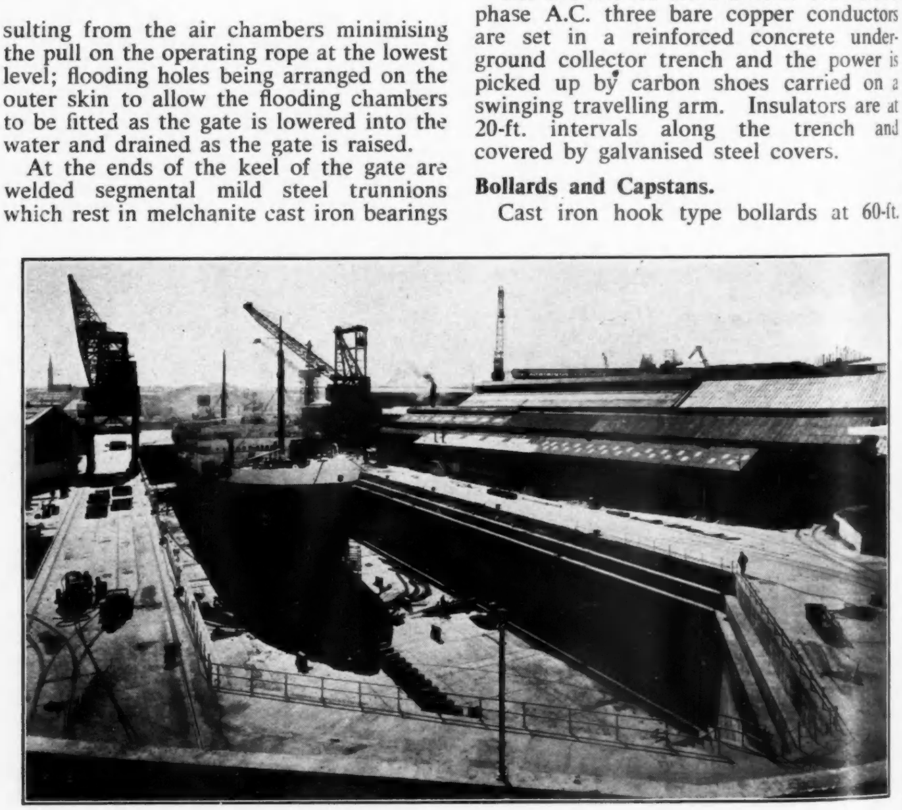
Crane tracks are provided on both sides of the dock each of 25-ft. gauge. The crane rail further from the cope being supported on a reinforced concrete beam carried by "Holmpress" cast-in-situ piles while that nearest the cope is supported on the subway roof and thence on to dock wall. Between the two crane rails there is a 24-in. thick reinforced concrete slab of sufficient strength to carry road and rail traffic including loco cranes.

On the North side an electric travelling portal type crane built by Sir William Arrol & Co. Ltd. capable of lifting 50 tons at 90-ft. radius with an auxiliary hoist of 16 tons at 155-ft. radius has been provided, while on the South side a Stothert & Pitt 10 ton crane with a working radius of 135-ft. is installed. The crane tracks are of twin 80 lbs. per yard F.B. rail riveted to a continuous 16-ft. x ¾-in. sole plate bolted down at 2-ft. 6-in. centres, the running table of the rails being ¾-in. above the concrete surface.

The current for the cranes is 440 volts 3 phase A.C. three bare copper conductors are set in a reinforced concrete underground collector trench and the power is picked up by carbon shoes carried on a swinging travelling arm. Insulators are at 20-ft. intervals along the trench and covered by galvanised steel covers.

Bollards and Capstans.

Cast iron hook type bollards at 60-ft.



Vessel in completed dock.

New Dry Dock at Wallsend—continued

centres are provided on the cope for the full length of the dock.

Four capstans each of 15 tons capacity at a speed of 50-ft. per minute are installed. Two with normal contactor type control gear are sited at the entrance where it is anticipated they will be also used in the handling of propellers, rudders and tail shafts. The two dock head capstans are of fluid drive type. All capstans were supplied by Stothert & Pitt Ltd.

Keel Blocks.

Cast iron keel blocks each of 3 sections are situated on the centre line of the dock. The blocks have a base of 5-ft. x 2-ft. and a total height of 2-ft. 9-in. They are each capped with one 18-in. x 12-in. and one 18-in. x 6-in. oak block, and topped with 3-in. of soft wood making a total height of 4-ft. 6-in. The Lion Foundry Co. of Kirkintillock supplied the blocks, one of which was satisfactorily tested under a load of 540 tons, twice the estimated maximum working load, without sign of failure.

Shores.

Telescopic steel shores of the "Elderslie" pattern were supplied by Tubewrights. Thirty-six in length ranging from 12-ft.—20-ft. and thirty from 20-ft.—30-ft. being provided. These are readily adjustable in steps of 12-in. and are found to be convenient to handle.

Handrails.

Galvanised mild steel handrails and standards have been installed round the cope and also on each of the two upper altars. All the fittings are Kee-Klamp pattern supplied by Gascoigne & Co. Ltd. The rails and posts are readily removable should the necessity arise.

Ancillary Buildings.

A prefabricating shop built in 1953 has been extended to form a Platers Shed, giving one bay 45-ft. wide x 318-ft. long and 43-ft. high to crane rail equipped with a 15 ton E.O.T. Crane, with a second bay 140-ft. x 50-ft. with a 3 ton E.O.T. Crane. Plate rolls, punching and shearing machines, scarphing machines, cutting and welding equipment sufficient for extensive repair work to be undertaken in the company's four dry docks have been installed.

A brick building 60-ft. long x 30-ft. wide x 20-ft. high houses a 3,000 cu. ft. min. electrically driven air compressor and two boilers to generate steam at a pressure of 160 lbs. per sq. inch.

Construction of a further two storey building about 160-ft. long x 55-ft. wide is now being carried out to house the general stores, riggers and mould loft, tool store, electricians shop, etc., as well as adequate washing and lavatory accommodation for workmen and ships' personnel.

The completion of this building scheduled for February, 1958, will bring the reorganisation of this repair yard to a conclusion, equipping it for the efficient repairs of all classes of ships.

Handling Bulk Sugar in Australia

Increase in Mechanisation at Ports

The recent opening of a new bulk sugar loading terminal at Mackay, Queensland, some details of which were published in the Topical Notes columns of the June issue of this Journal, represents a further step in the rapidly changing methods of handling sugar cargoes in Australian ports. During recent years bulk sugar handling installations have been erected at Pyrmont, Sydney, at Yarraville, Melbourne, and at the sugar mills at Harwood and Broadwater on the Clarence and Richmond Rivers. Installations at present under construction at Lucinda Point and Bundaberg are expected to be completed by 1958 and others are under construction or are contemplated at Cairns, Mourilyan and Townsville.

Unloading Plant at Melbourne.

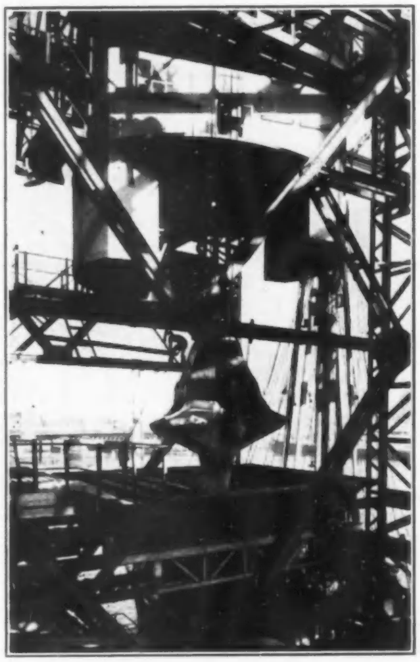
At the Port of Melbourne the import of raw sugar is one of the main interstate imports. In 1953, 130,198 tons of raw sugar were imported, all bagged. During 1956, 174,709 tons were imported of which 126,540 tons were handled in bulk.

Engineering and economic investigation was carried out at the Yarraville berths to determine the most suitable method of bulk handling and, although not highly mechanised, the method chosen was considered to be the most efficient.

The sugar is grabbed from the ship's hold and emptied into mobile hoppers, stationed on the wharf apron to suit the position of the ship's hatches. The load from the hoppers is deposited into motor lorries which then transport the material to the nearby warehouses where the lorries are unloaded into special throwers engaged on building the sugar into mounds for storage until such time as it is needed for the further refining processes.

The Pyrmont Refinery Wharf, Sydney.

The equipment for unloading and storing raw sugar at the Pyrmont refinery has been in operation for over a year. The cargoes are handled in four stages. In the first phase of the operations the sugar is grabbed from the ship by two semi-portal transporter cranes, 112-ft. high, running on rails parallel with the wharf. Each crane is independent of the other and consists of a main structure which rests on the wharf and contains a receiving hopper and a short band conveyor. A hinged boom, supported by the main structure, can be raised from a horizontal to an almost vertical position to clear ship's masts or other gear. The boom is fitted with rails which, together with a railed section at the same level in the main structure, provide a runway for the crane trolley. The crane trolley, from which the grab and operator's cabin are suspended, moves out to a position over the ship's hatch and back over the receiving hopper built on to the crane and into which the grab discharges the sugar. The mobility of the cabin enables the driver



The loaded grab emptying into the hopper which is built into the crane.

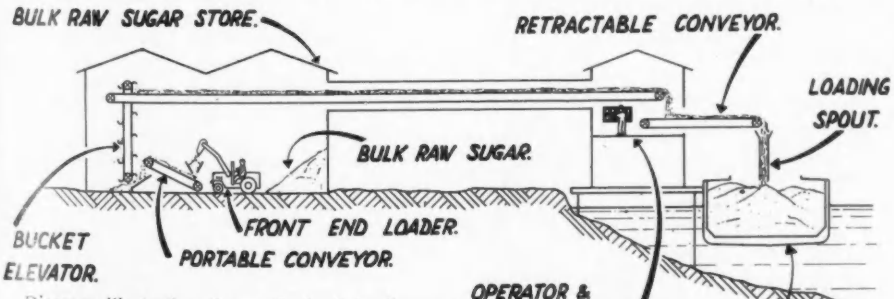


Diagram illustrating the method of loading raw sugar in bulk at Harwood Mill on the Clarence River, Northern N.S.W.

Handling Bulk Sugar in Australia—continued

to be in a position to see the grab all the time it is operating in the hold and also when discharging the load into the hopper. The visibility of the cabin has also been increased by the front of the cabin being built entirely of glass and set at such an angle as to enable the occupant to see into the hold directly beneath him as well as in a forward direction. The cabin can be rotated in a full circle together with the hoisting machinery and the grab.

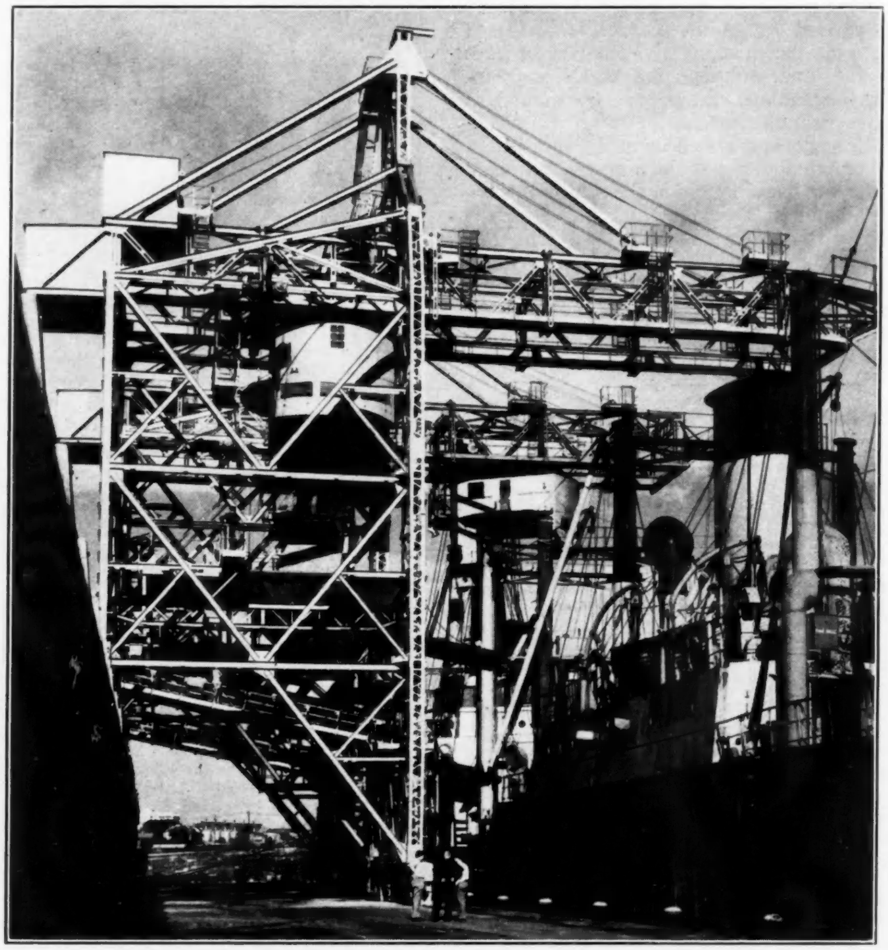
The cranes were constructed by Messrs. Stothert and Pitt Ltd., Bath, England, in accordance with a general specification and outline plans prepared by the engineering department of the refinery. In principle they are similar to the cranes used by the Australian Iron and Steel Ltd., for unloading iron ore at No. 2 Jetty, Port Kembla.

The grabs used are of the "Voorwinde" ("Trojan") type which were developed in Rotterdam for handling coal. This type of grab has a wide span, a heavy bite and can be manipulated by the driver so that, when it is opened, one jaw remains stationary, thus enabling the driver to "walk" the grab in the hold of the ship beyond the hatch opening. Leaving a heap in the centre of the hold, and using the base of the heap as a heel, the driver is able to open the grab into the farthest corners of the holds so that the need to trim sugar to the grabs at any stage of the discharge is avoided. The grab has a spread of about 18-ft. when fully opened, weighs five tons, and when fully loaded it lifts approximately 4 tons of sugar.

The fact that the cabin, the grab and the hoisting machinery can be rotated in a full circle is complimentary to this method of working.

When a ship is berthed the cranes work continuously and a 4,500 ton cargo of bulk sugar can be discharged in less than 24 hours. The average unloading rate of each crane is roughly 110 tons per hour with a peak performance of up to 250 tons per hour when unloading the ships at present in use. These ships have been converted for the transport of bulk commodities but when the specially designed bulk carrying vessels come into service discharge rates approaching those for which the cranes were designed, 350 tons per hour, will be achieved.

From the hopper in the main structure of the crane the sugar is fed on to a small band conveyor which in turn discharges the sugar on to a conveyor arranged along the rear line of the wharf behind the cranes and adjacent to the storage sheds.



The two cranes unloading a cargo of bulk raw sugar at Pyrmont. The crane in the foreground is emptying sugar from the grab into the crane hopper.

The sugar is conveyed from the wharf to the second stage of the operations in which it is weighed at the automatic weighing station. The station consists of three large hoppers one above the other with, at the top, a feed hopper, beneath the feed hopper a weigh hopper and at the bottom a discharge hopper. The raw sugar is weighed automatically in batches of up to 28 tons.

Conveyors elevate the sugar from the discharge hopper to the roofs of the stores for the third stage, storage, preparatory to it entering the fourth and final stage—conveyance to the refinery.

In the bulk stores the sugar is ploughed off the conveyors at pre-selected points and falls on to the concrete floor. The resultant piles are levelled by means of dragline scrapers. The stores at Pyrmont have a capacity of about 50,000 tons and the normal height of a stockpile of sugar in the storage area is about 30-ft.

The refinery draws sugar from the store at an even and slow rate in comparison with the speed of ship unloading and much simpler equipment is used at this end of the operations. Tip trucks are filled by mobile bucket loaders and unload into underfloor hoppers. From the hopper the material is fed by an elevator and band conveyor system to overhead storage bins and subsequently to the refinery.

Loading Plant.

At the Harwood Mill on the Clarence River, N.S.W., sugar for transport by sea to the Pyrmont refinery is loaded by a front end loader working in the bulk sugar store on to a portable conveyor. This conveyor discharges on to an elevator which carries the sugar up to almost roof level and on to a further overhead conveyor running to the wharf. An operator at the wharf controls a retractable conveyor on to which the overhead conveyor discharges. Finally, the retractable conveyor deposits the sugar, by way of a loading spout, into the hold of the ship.

The ships carrying sugar from the Clarence and Richmond Rivers are much smaller than those from the Queensland ports and are unloaded by a similar system to that employed at the Yarraville refinery at Melbourne.

The primary considerations involved in the installation of bulk handling machinery were the need to combat the high cost of packaging, shipping and handling raw sugar, to improve the co-ordination and control of sugar transport and to eliminate the arduous labour involved in manhandling bags.

At Pyrmont the time period for the unloading of sugar ships has been reduced from one week to twenty-four hours. The use of jute bags, which in 1951 cost the Colonial Sugar Refining Co. Ltd. £4½ million, has been partly eliminated and as bulk loading terminals are constructed at other Australian ports the need for bags will become progressively less.

The bulk handling of sugar thus takes its place in the growing pattern of mechanisation at Australian ports and is a further example of the continuous progress they are making in cargo handling methods.

The Investigation and Design for Portland Harbour, Victoria

By E. P. C. HUGHES, O.B.E., B.Sc.(Eng.)*
(Chief Engineer, Portland Harbour Trust)

(Continued from page 209)

General Design.

The work of design divided itself naturally into two main phases—the layout and the design of the structures. Much thought had been given to the harbour layout in the past by the Public Works Department and by consultants at various times and most recently by the London Consultants to the Government whose knowledge and experience in such matters was profound and greatly respected.

The task of layout design became one of combining the best features of past studies in the light of the detailed investigation work then proceeding. The size and shape of the harbour and the number of berths became defined, and from detailed studies of expected cargo movements the layout of roads and railways was fixed.

One major deficiency in the older ports is lack of space at the wharf side and it was this factor, together with the maxim that "the ship can always beat the shore," which was kept in the forefront of design considerations. Studies were made of modern layouts overseas, and an attempt was made to adjust the criteria adopted by other ports to the conditions expected in Portland.

Although the harbour at Portland would be largely unfettered by existing structures such as there are in larger centres, there were still certain physical limits to construction. In addition, it was felt that excessive interference with the existing town could lead to serious delays while legal and political arguments proceeded and could also lead to antagonisms which were already all too powerful in the early days of the Trust's existence.

The studies and investigations made led to the adoption of the following list of desired conditions for an ultimate development plan:

- Water area—about 250 acres,
- Main breakwater—4,300-ft.,
- Lee breakwater—3,700-ft.,
- Harbour entrance to face north,
- Entrance width—600-ft.,
- Overlap of main breakwater to be decided after model tests,
- Cargo berths to be provided:
  general overseas cargo—six, bulk cargo—two, tanker berths two, coastal berths—four,
- Land space available at the ship's side per general cargo berths—5 acres,
- Land space available at the ship's side per bulk berths—3 acres,
- Storage space available near berths—50 to 60 acres,
- Every possible means of transport to be available from ship to storage areas,
- Wharf cranes to be used throughout the port,
- Depth of water—36-ft. with provision for deepening to 40-ft.,
- Pre-cooling transit storage to be provided at the wharf side for perishable cargoes,
- Special arterial roads to connect the port to industrial areas of the town,
- The design to be suitable for implementing in stages with the demands of trade.

As the harbour was an artificial one it was felt that space for private berths inside the breakwaters could not be spared, and a compact layout suitable for operating by a single authority was essential.

These criteria formed the basis of the ultimate development plan, and from this a Stage 1 plan for immediate construction was produced giving basic facilities ready for further development.

In the design and arrangement of structures it was decided to build models to test the general shape of the harbour for possible resonant effects such as have caused trouble in many ports which face an open ocean and to assist in the perfection of a main breakwater design.

Three-dimensional Model (Fig. 5).

This model was constructed to test the ultimate development arrangement of the harbour structures for possible resonant effects which might result in the ranging of ships alongside the wharves. This phenomenon can be a very serious cause of delay in port operation apart from the possibility of damage to the ships in extreme cases. The remedy for conditions of range in a harbour can only be found with certainty by a model, and the technique of model testing is now well understood and documented.

The scales for the model were chosen to be as large as possible consistent with economy. No suitable building was available and an open air model had obvious disadvantages in a coastal climate, so it would be necessary to build a shed especially. After much argument and compromise, scales of 1 in 210 horizontally and 1 in 70 vertically were chosen, allowing the model to be built in a shed 40-ft. x 50-ft. The distorted scale was considered necessary to avoid bottom friction effects in the shallow water areas of the harbour.

As a preliminary a tank was constructed 50-ft. square and 18-in. deep in concrete, waterproofed with two coats of tar. A series of three-ply cross section profiles were next made from a contour plan of the harbour area and these were located side by side at 2-ft. intervals across the tank. The spaces between the profiles were then filled with $\frac{3}{4}$-in. aggregate to within an inch of the top of the profiles, and the whole floor was then finished with one inch of rendering bringing it flush to the top edges of the profiles.

The harbour in its ultimately developed stage was next constructed on the model sea bed and dredged areas were excavated and re-formed with rendered surfaces to correct depths.

At this stage the breakwaters were considered likely to be of rubble mound construction and wharves of mass gravity type. It was felt that in the prototype some of the energy of waves attacking the breakwater would be likely to get through a rubble mound structure, and a series of tests in a flume with model breakwater sections was carried out to devise a means of constructing the model so that the correct amount of wave energy would get through. This problem was successfully overcome by building the model breakwater of selected stone metal over a tunnel of flywire

Fig. 5. Three-dimensional model with scales of 1 in 210 and 1 in 70. Model Harbour viewed from north east.

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The Investigation and Design for Portland Harbour, Victoria—continued

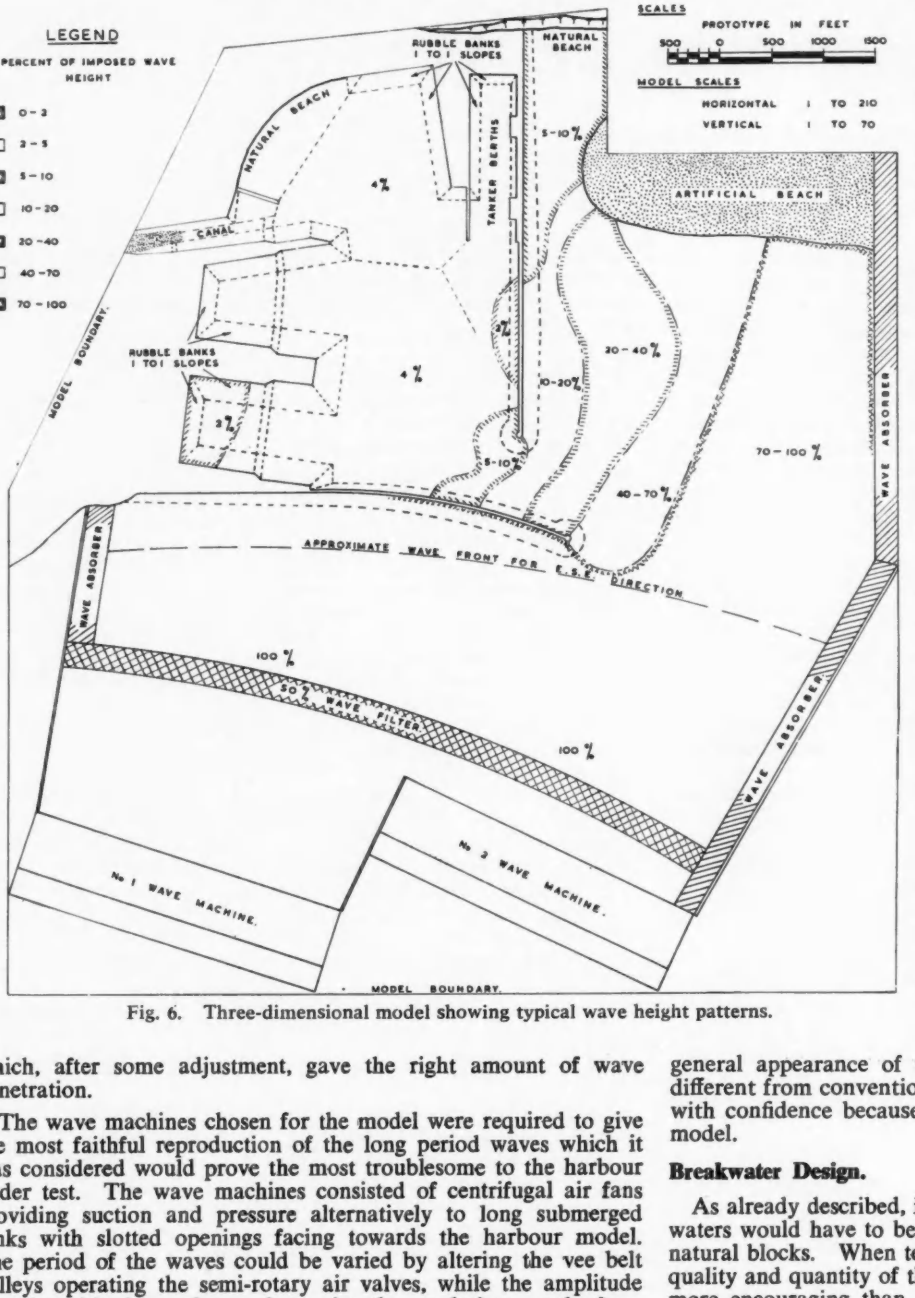


Fig. 6. Three-dimensional model showing typical wave height patterns.

which, after some adjustment, gave the right amount of wave penetration.

The wave machines chosen for the model were required to give the most faithful reproduction of the long period waves which it was considered would prove the most troublesome to the harbour under test. The wave machines consisted of centrifugal air fans providing suction and pressure alternatively to long submerged tanks with slotted openings facing towards the harbour model. The period of the waves could be varied by altering the vee belt pulleys operating the semi-rotary air valves, while the amplitude was altered by increasing or decreasing the revolutions on the fans.

The model tests were carried out under all conditions of long period and short period waves, and the amplitude and general characteristics of the waves outside and inside the harbour were recorded on a film attached to a cathode ray oscillograph. The oscillograph was wired to a simple portable electrode gauge and arranged so that the amplitude of the reading could be increased to many times greater than the actual water movement being recorded by the gauge. Vertical water movements recorded were plotted on charts of the harbour to show the wave amplitude inside the harbour in different areas expressed as a percentage of the wave height outside (Fig. 6).

Analyses were also made from these results to give horizontal water movements to be expected, and the oscillatory responses along different lines of modes inside the harbour were recorded corresponding to the most important wave conditions in the open sea.

Two-dimensional Model (Fig. 7).

This model was constructed to test the effectiveness and strength of the main breakwater section under the various wave conditions expected. The breakwater had to be designed to make the best use of the materials available, and economy in large-sized stones particularly was necessary.

The process adopted was to design the breakwater in the design office and to have the design tested by a separate group in the laboratory. It was found that considerable economies could be effected with the model, and weak points in the design were soon noted and put right.

The model tank was 40-ft. long, 4-ft. high and 2-ft. wide, having a glass panelled section at one end and a wave paddle at the other. A model of a short section of the breakwater on a scale of 1 in 40 was built in the tank so that its cross section showed through the glass panel. After filling the tank with water, waves were produced by the wave machine and observations of the effect on the model section observed and recorded by movie camera. It was found that basalt stone of the correct specific gravity used in the model tended to photograph badly and a change was made to the use of white marble of almost the same specific gravity and roughness.

A long series of tests of designs was carried out in this model enabling improvements to be made and weaknesses to be exposed. Different parapet sections were also tested and decisions as to sections to be adopted were greatly assisted by the direct observation possible.

The main breakwater design evolved from this model is conventional as to the general appearance of the cross section, but some details are different from conventional structures and could only be adopted with confidence because of the wave behaviour observed in the model.

Breakwater Design.

As already described, it was at first thought that concrete breakwaters would have to be built on account of the shortage of large natural blocks. When tests at Cape Grant Quarry were made, the quality and quantity of the larger sizes obtained proved very much more encouraging than first estimated, and the design of breakwaters in rubble mound construction was taken up. To achieve maximum economy it was necessary to design the breakwaters to use the different sizes of materials in the proportion in which they were produced by the quarry.

The main breakwater had to be designed as a wave resisting structure and the lee breakwater more as a groyne whose function would be to keep sand in suspension from drifting into the harbour.

It was apparent from the start that the greatest economy would have to be practised in the use of large natural wave-breaker stones due to their comparative scarcity, and the ingenuity of the designers was tested in devising sections with the greatest economy in protecting stone. The use of concrete "tetrapode" blocks was investigated, and sections protected by these as well as by natural stone blocks were fully tested in the model and economic comparisons were made. These comparisons showed that wave protection by natural blocks up to 8 tons in weight was likely to be more economical than by concrete tetrapodes, but that no sub-

The Investigation and Design for Portland Harbour, Victoria—continued

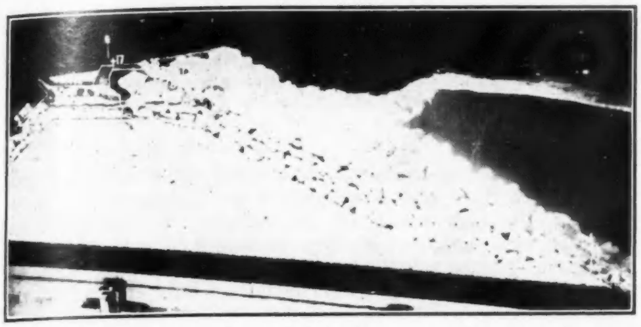


Fig. 7. Two-dimensional model showing cross section of breakwater on a scale of 1 in 40, constructed in a glass fronted section of wave tank with 16-ft. high wave breaking.

stantial reduction of the maximum below 8 tons could be tolerated without the artificial block becoming the more economical wave breaker of the two.

On this basis and from a forecast of quarry production it was assumed initially that the southern half of the main breakwater could probably be constructed with natural stone protection, but that beyond the half way mark artificial wave breakers would have to be used. However, as the work has progressed and as the quarry has opened, it has been found possible to plan for the use of natural wave breakers throughout the length of the main breakwater instead of only in the southern half.

The design evolved for the main breakwater was for a hearting mound of C class stone consisting of the general run of the quarry from 1 ton downwards. It was found in the model that stone of this size when left in mound unprotected was very quickly washed down by quite moderate seas, and an immediate temporary parapet of stones up to 4 tons from sea level to +8-ft. or 10-ft. had to be constructed on the seaward side of the mound so that a workable road for construction traffic could be maintained. It was decided that this lightly protected mound should be left exposed for as long as possible before the final protecting layers were placed, so that the maximum settlement in the hearting material could be induced. The hearting mound was accordingly designed to advance a distance representing nearly 12 months' progress before it was shaped up to the final section and protected.

The natural slope of the tipped hearting mound was found to be about 5 : 4, while the required slope on the seaward side to support the wave breakers was 2 : 1 below water and 5 : 1 above water. A part of this flattening from 5 : 4 to 2 : 1 could be expected from wave action, but the main shaping up had to be done by a big dragline machine of 3½ cu. yd. capacity.

The wave breakers were stones of 4- to 8-ton size laid over a layer of 1- to 4-ton stones which in turn rested on the hearting of the breakwater. This grading of the stone was necessary in order to obtain the effect of a self-choking filter.

Not only was the finished breakwater tested in the two-dimensional model but it was also found helpful to simulate the construction process which had a considerable bearing on the breakwater design.

The top of the breakwater is designed to be capped with a mass concrete parapet cast in place in 120-ton blocks providing a 14-ft. wide maintenance roadway, with a high spray wall on the shoreward side where the breakwater is backed by reclamation, and supporting a low upper parapet on the seaward side for the outer 2,200-ft. of its length (Fig. 8).

The necessity for the construction of a lee breakwater was at one time challenged as it could be shown from the three-dimensional model that this structure had no vital function in keeping out the waves and, indeed, it could be shown to assist certain internal undesirable wave resonances in the harbour basin which, however, were replaced by others if the lee breakwater was removed. However, it seemed imprudent to discard the structure so lightly in view of its other useful functions, one of which was to restrict the entrance of the harbour and so reduce the invitation to sand accretion, and the other was to serve as a jetty for the accommodation of tankers. Accordingly, the structure was retained in the scheme and was designed as a simple rubble mound with a light wave protection from just below sea level upwards.

Wharf Design.

In the layout design adopted, the wharf was to be backed by reclamation and was required to provide 36-ft. of water alongside with provision for deepening one of the two berths to 40-ft. in the future. The wharf was to be designed for bulk handling, and it would therefore be required to carry heavy grab cranes and possibly other heavy equipment.

It was considered that the ideal type of wharf to fufil these requirements would be a gravity wall backed by reclamation, but this type would require a good foundation to be economical. When the sea-bed borings were done on the line of the wharf it was found that the foundation material was not good and the decision was

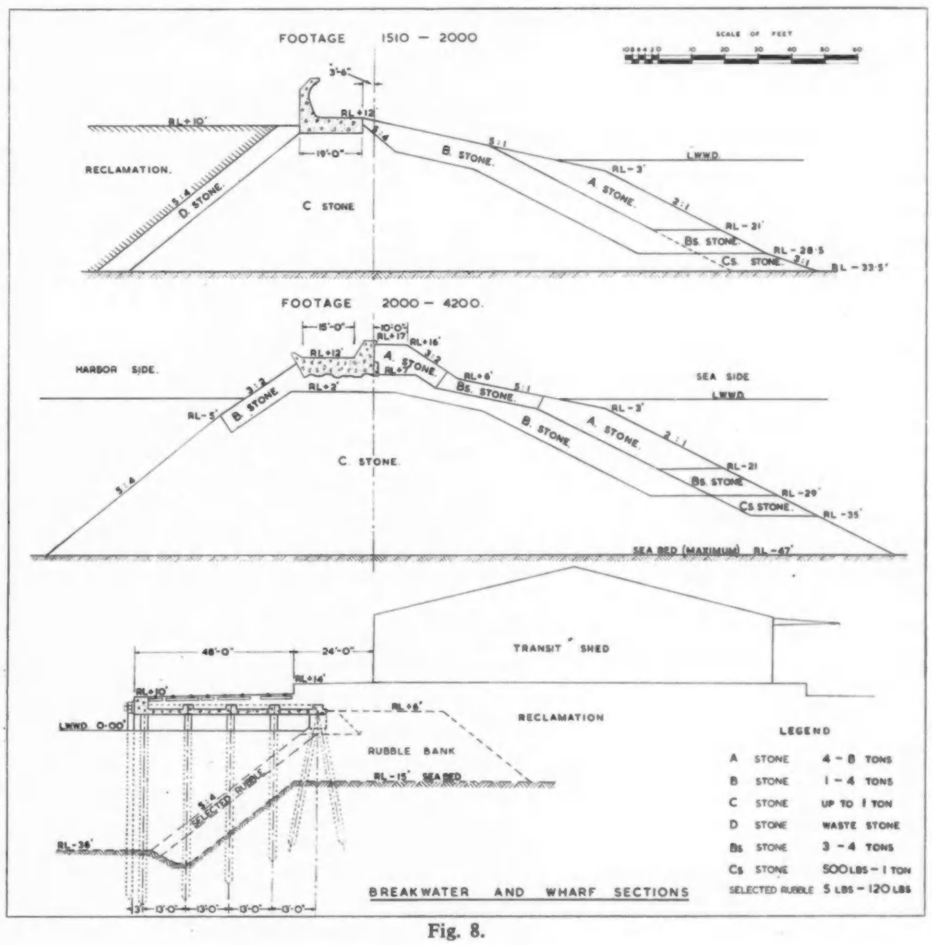


Fig. 8.

The Investigation and Design for Portland Harbour, Victoria—continued

made to retain the reclamation by a rubble bank and to build the wharf over the sloping rubble face on piles.

In order to make allowances for the heavy point loads, the wharf was designed as a reinforced concrete relieving platform, with the wharf surface 5-ft. above the underside of the deck and with a cushion of sand filling over the top of the concrete deck slabs (Fig. 8). The deck was designed in precast panels 13-ft. square in plan with edge beams in the upper surface and with flat undersides.

The piles at 13-ft. centres were required to carry a maximum load of 100 tons each with an exposed height of 45-ft. above the sea bed and a reinforced concrete pile of a diameter 26-in. was found to be necessary with a maximum length of 65-ft. Such a precast pile would weigh 15 tons and require heavier handling and driving equipment than usual. In addition, some of the piles would have to be driven through the rubble comprising the reclamation retaining bank and there were possibilities that damage might occur during driving in this material.

As a solution to these difficulties the piles were designed to be driven as hollow tubes of thin steel plate subsequently filled with concrete and as a membrane to prevent deterioration of the concrete subsequently. Cathodic protection for the steel shell below water is proposed.

The following are details of criteria for the wharf design:

Length—	1,300-ft.,
Loading—	train, Cooper's E.50 crane, 42 tons on one cirner,
Live load—	normal 500 lb.-sq. ft. distributed,
Deck level—	+10,
Underside of deck—	+5,
Depth alongside—	outer berth, 36-ft. with provision for 40-ft., inner berths, 36-ft.,
Wharf tracks—	crane track and 3 broad-gauge tracks,
Fenders—	rubber tubular on timber facing,
Bollards at 39-ft. centres,	30-ton capacity.

Railways.

The railway system in the port area and the 3 mile long connection to the main line was designed in collaboration with the Chief Civil Engineer's staff of the Victorian Railways.. Three rail bridges and one road bridge were involved in the plan, and conventional designs were adopted for these. Victorian Railways track and drainage standards were adopted whenever possible, and sidings were designed with flush-type crossing levers so that tractor shunting could be employed.

Transit Shed.

An early decision had been made that the port should be designed to be fully mechanised both as regards wharf gear and as regards quay cranes. Accordingly, the transit sheds were designed with platforms front and back and at the two ends, the wharf-side platform being 24-ft. wide to allow for landing and breaking open the crane slings and for making up cargo sets for export.

In this the first stage of construction only one transit shed was required, and this was designed as a conventional single-span building 120-ft. x 500-ft. with 10 per cent. natural lighting provided by perspex panels in the roof sheeting and glazing in the walls.

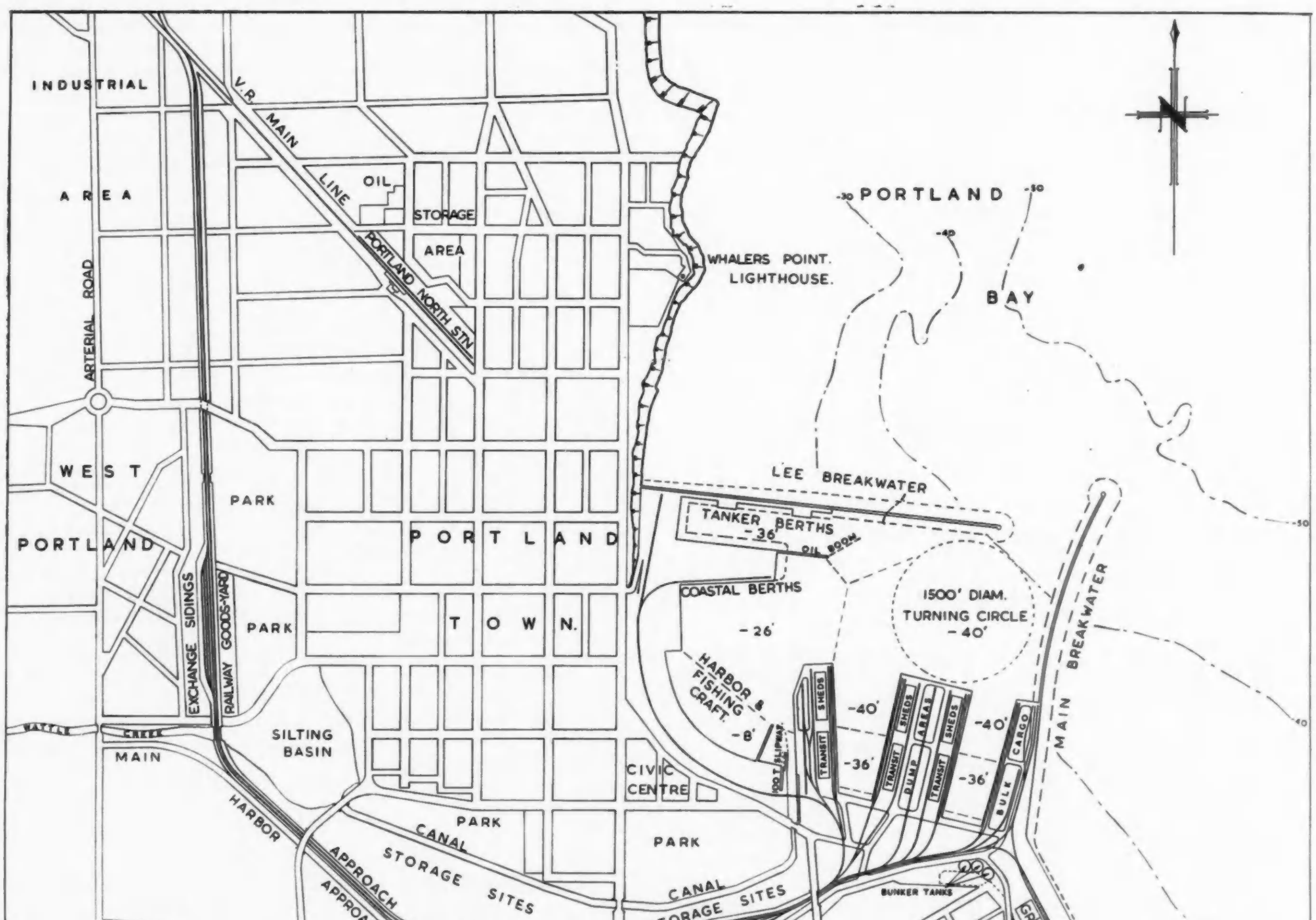


Fig. 9. Portland Harbour; proposed ultimate development.

The Investigation and Design for Portland Harbour, Victoria—continued

For later stages it was proposed that at least some of the transit sheds would be equipped with basement cool stores fed by galleries under the front and rear platforms and with hatchways in the wharf-side platform giving access to the gallery below.

Canal Bridge.

The salt creek which flows into the new harbour is to be converted into a canal providing access for barge traffic to storage sites, in addition to its function as a stormwater outlet. The main connection between the commercial town and the new port along Cliff Street crosses this canal and necessitates a bridge of 40-ft. clear span with 15-ft. of headroom at low water and with a canal bed level of − 10-ft. In the design of this structure the assistance of Consulting Engineers was obtained to give some relief to the Trust's small design staff. A box culvert design was adopted in reinforced concrete with a prestressed concrete deck.

Slipway.

For the maintenance of harbour craft and for the Trust's own floating plant a 100-ton slipway was included in the design. The foundation material at the site of this slipway consisted of small boulders bedded in silty sand and underlain by the usual limestone which forms the harbour bed in deeper water. This formation of boulders in sand is extremely difficult to excavate and at the same time provides a very solid foundation. Accordingly the slipway was designed as a normal ballasted track but on longitudinal sleepers and with the ballast grouted up with cement grout instead of being packed.

The slipway consisted of two rails at 10-ft. centres on a 1 in 18 grade from a level at plus 9-ft. to a depth below low water of 9-ft. with provision for extension to a depth of − 12-ft.

A cradle was designed as a multi-wheel double carriage unit with single flanged wheels. The wheels were mounted in short bogies in pairs so that each carriage was supported on four bogies with eight wheels, the whole cradle having eight bogies with sixteen wheels.

Second-hand 97 lb. rail was employed but caused considerable difficulties in construction owing to the matching up that was necessary. The track was designed for assembly in lengths above water and subsequent lowering into prepared pads of bag concrete. The ballast was filled up to rail level and screeded off and then stabilised by injection of a 1 to 1 cement grout.

Future Expansion.

In addition to the expansion of the port facilities in future stages as already indicated, it was considered necessary to make provision for industries closely connected with the facilities offered by the port and which it was not possible to locate in the port area. To this end an area of 1,000 acres of undeveloped scrub land 2 miles south of the harbour was acquired by the Trust, and road and rail link proposals were surveyed and examined.

In addition, a shallow bay immediately south of the main breakwater was reserved for reclamation to form the site for grain elevators and their attendant sidings when the demand arises.

Full Development Plan (Fig. 9).

From the foregoing studies and the decisions derived from them, the following plan for the fully developed harbour at Portland was evolved; this development is not expected to be reached for 30 years and is intended to be undertaken in stages:

The harbour to be closed by two breakwaters of rubble mound construction at right angles to each other and with a 600-ft. wide entrance measured on the bottom of the channel. The main breakwater to be curved outwards to improve the entrance for shipping and to approach the alignment at the outer end and to that of the wave crests. The main breakwater to overlap the lee breakwater by about 500-ft.

The turning circle inside the entrance to be 1,500-ft. dia. with a depth of 40-ft. below low water. Underwater dredged slopes to be 1 in 6.

The southern part of the harbour to be developed for overseas shipping with eight berths on four wharves each 1,300-ft. long. The outer berths to have 40-ft. of water and the inner 36-ft. The two berths on the main breakwater to be reserved for bulk cargoes and to be designed to carry 7½-ton grab cranes. The probability of a grain loading gantry on this wharf to be taken into account.

The lee breakwater area to be reserved for two tanker berths with 36-ft. of water and space at the shore end for bulk storage of oil.

The western part of the harbour to be developed for coastal shipping with four or five berths with 26-ft. of water.

The present Ocean Pier and the Railway Pier to be removed and the present Henty Beach to be developed for fishing craft, pleasure craft and harbour craft generally.

The present fishermen's breakwater area to be improved and deepened for the use of the fishing industry and for boat building and repairs.

Wharves generally to have three lines of tracks and one crane track. A group of sorting sidings to be located on reclaimed land in the swamp area adjacent to the harbour and exchange sidings approximately half-way from this point to the junction of the railway approach with the main line. The railways to own and operate the line as far as the exchange sidings and the Trust from thence to the port.

Transit sheds generally to be single storied with platforms all round, and wharves and sheds to be completely mechanised. Selected berths to have basement cool stores of the pattern adopted by the South African harbours.

All port roads to be gathered to a 4-lane arterial road which will proceed parallel to the railway siding until it can join the arterial development of the town "Boundary Road." The Fawthrop Lagoon and Henty Park swamp areas to be reclaimed and made available for selected storage sites. The present salt creek to be canalised both to carry storm water and to provide lighter access to the reclaimed storage sites. A silting basin to be provided at the north end of the canal to intercept silt brought down from newly developed areas inland. Two tankers to be accommodated in an oil dock against the lee breakwater with provision for closing the dock with an oil-tight boom.

The first stage of this plan comprising the shell of the harbour and two new berths with road and rail facilities is now under construction and is due to be completed in 1959.

Will There be Too Many Tankers?

Atomic Power *versus* Oil Fuel

(By a Special Correspondent)

Should there be a re-adjustment of tanker planning? This is the issue raised by Mr. W. G. Weston in a Westinform Shipping Report entitled "Europe's Long-term Fuel Prospects." Mr. Weston was formerly a deputy secretary of the Ministry of Transport, and later a general manager of the Shell tanker fleet, and therefore ranks as an expert. His views will be studied with attention, particularly by dock authorities.

There have been one or two significant happenings since the report was published. First, the announcement by an American shipowner that he has placed an order in Japan for five oil tankers of 104,000 tons deadweight each. Second, the increase in tanker tonnage laid-up throughout the world, now aggregating over a million d.w.t.

Admittedly the plans for the super-tankers must have been settled some time ago, but the placing of the orders suggests that faith in the future of these giants is strongly implanted in the minds of some shipowners. Mr. Daniel K. Ludwig, who is responsible for the orders, is the pioneer of the large bulk carrier, and although the tonnage of the projected vessels is 2,000 tons less in each case than those ordered by Mr. Stavris Niarchos, they will be bigger than the two of 100,000 tons to be constructed for Mr. Aristotle Onassis, who is also reported to be negotiating for five more tankers of similar size.

As to laid up tanker tonnage, a comparison with September and October figures is illuminating and shows the effect of the drastic fall in freight rates. At the beginning of October the

Will There be Too Many Tankers?—continued

total laid up in the world was under 500,000 d.w.t. A month later this figure had more than doubled. The oil tanker market has, of course, gone through and survived similar depressing times to those now being experienced. Various dock authorities are already committed to schemes for enlarging docks so as to be able to accommodate much larger tankers than present dimensions will allow.

Have past pronouncements about the anticipated great growth in the demand for oil products been too optimistic? In the next few years there will come into commission a substantial number of new tankers (including those ordered by the P. & O. company) and the outlook would certainly be unhappy if the present pause in the expansion of world trade, with which is bound up oil consumption, should continue.

Coming now to the Westinform report, it is admitted that, owing to the diversity of the statistical sources used, and the lack of definite information on the plans adopted by many of the countries of Western Europe (including the O.E.E.C. countries, together with Finland, Spain and Jugoslavia) concerning fuel requirements, it gives results less exact than those published in an earlier report on an energy balance for the United Kingdom. However, it is suggested that these results represent the most likely possible outcome of the trends at present discernible.

Tanker Employment

Western Europe, says the report, at present employs nearly 50 per cent. of the world tanker capacity and 30 per cent. of world tramp tonnage engaged on carrying fuel. Nuclear power output in Western Europe, in terms of million tons of coal equivalent, is envisaged as a rising from 5 in 1960 to 230 by 1975, as shown in the following table:—

	1960	1975
United Kingdom	3	80
Euratom powers	2	135
Other W. European countries	0	15
	5	230

The "gap" between Western European requirements of fuel and the domestic supplies available would be stabilised after 1970, says the report, at roughly 300m. tons of coal equivalent a year. This is, of course, surmise, as is the belief that coal-importing authorities will try to stabilise coal imports at not more than 50m. tons a year. The limits to which oil companies should build up refining and transport capacities for Europe, therefore, are suggested in terms of 265m. tons of coal equivalent of oil, namely, 180m. tons of oil, by 1970.

The conclusions reached are:—

(1) The current rate of expansion of oil and coal imports are not likely to be maintained. If coal imports are stabilised at 50m. tons per annum, the residual oil gap would be as follows:—

	Million tons				
	1956	1960	1965	1970	1975
Coal (approx.)	40	45	50	50	50
Oil (coal equivalent) ...	150	200	225	265	260
Oil (million tons) ...	100	135	150	180	175

(For the benefit of readers it should be explained that the coal equivalent of a ton of oil is just over $1\frac{1}{2}$ tons. Thus, the residual oil gap is obtained by reducing the coal equivalent figures by one-third, using the reciprocal of $1\frac{1}{2}$).

(2) If oil companies build up refining and transport capacity beyond the levels suggested here as required in Europe (or in the United Kingdom only, since atomic developments in the case of this country are further advanced than in Europe) there will probably be competition, to a more or less severe degree, between domestic coal, domestically-refined oil, and imported coal. The extent of the competition and its results will depend on the relative prices of these commodities.

(3) In any event, it is likely that atomic power developments will have unfavourable repercussions on the expansion of, and later on the maintenance of, the demand for shipping, both oil-carrying and dry-cargo.

Mr. Weston believes, therefore, that a start should be made at once on a re-adjustment of tanker planning assumptions and a change of methods, particularly as by the early 1960s added complications may have affected the tanker industry, with possible alternative methods of transport for Middle East oil to Western Europe and the expansion of nearer sources of supply.

The Port Health Authority

By T. L. MACKIE, M.B.E., F.R.S.H., M.I.N.A. (Member)*
(Chief Inspector, Port of London Health Authority)

It is not surprising that a maritime nation like the British should place emphasis on the safeguarding of their ports—seaports and airports. With seaborne trading connections in all parts of the world, these islands, though favoured by geographical location, would nevertheless have been vulnerable to the importation of devastating communicable diseases unless properly organised defensive measures were constantly maintained.

Mankind has dreaded the spreading capacity of certain communicable diseases since time immemorial and has realised that the casual agents of these diseases cannot obviously be confined naturally within territorial frontiers.

It was not, however, until the Middle Ages that any really serious attempts were made to curb the spread of these diseases into seaports, thence to adjoining territories. In these attempts, the control of bubonic plague was given priority and the Venetians of that time, who were prominent sea-traders with the East, decided to implement laws and operate a maritime quarantine organisation, which was probably the first of its kind in the world. The basic principles included the isolation of ships and crews as well as the cargoes when they were suspected of carrying communicable disease. This period of detention was extended to a minimum of forty days. Subsequently, this example was adopted by other seaports and the substantial share of these quarantine demands imposed on men, ships and cargoes, has served as a pattern for quarantine regulations until comparatively recent times.

I. Port Sanitary Authorities

Eventually the Public Health Act, 1872, empowered the Local Government Board to constitute Port Sanitary Authorities with assigned powers which were practically limited to the detection and isolation of the more dangerous communicable diseases. Thereafter followed the more decisive instrument contained in the Public Health Acts of the years 1875 and 1891, which added considerably to the powers and scope of the Port Sanitary Authorities to inspect vessels and shore premises within their districts. Although the basic principles continued to be observed in these ports, it was decided to abandon the practice of putting ships into isolation anchorages and to replace this measure by an immediate medical inspection and to allow ships, together with their crews, to be dealt with according to the health conditions prevailing during the voyage. And so ended a memorable period of seventy years' constructive effort which was to herald a new era of stimulated endeavour and continued achievement.

(a) Initial Responsibilities.

To deal effectively with a perpetual movement of international shipping and a variety of port premises is a feature peculiar to port sanitary administration. Overseas commerce being so vital to the nation's economy and an unhampered distribution of sound imported food so essential to the nation's larders, it was essential for the port health authorities to function properly without unduly impeding the flow of trade.

The newly appointed Medical Officers and Sanitary Inspectors had ample scope for hard work and enthusiasm. Of course, no organisation could ever function in a progressive society without exposing some form of imperfection. In spite of all the limitations and the relatively intolerable sanitary conditions then encountered aboard ships and in the ports, these few officials tackled their assignments quite undismayed and acquitted themselves in a manner worthy of admiration.

* Paper presented at the Annual Conference of the Association of Public Health Inspectors, September, 1957, and reproduced (slightly abridged) by kind permission.

The Port Health Authority—continued

The new era confronted them with arduous and extraordinary experiences, where unruly crews and "floating slum" conditions were not exceptional circumstances and their conveyance from one ship to another was almost entirely dependent on the open rowing boat and their legs.

Fortified with statutory powers and established firmly on the foundations of the earlier quarantine principles, the constituted Port Sanitary Authority was charged with the primary responsibility of ascertaining and intercepting infectious diseases and eliminating any conditions deemed as nuisances and prejudicial to health.

Coinciding with this commitment, the officers of H.M. Customs retained the right to withhold "pratique" from ships arriving from certain foreign ports until the Port Medical Officer had satisfied himself concerning the health conditions present and prevailing over the voyage. Pending his decision, the ship had to be denied any contact with the shore or any unauthorised person, even to the extent of being ordered to isolation at a designated anchorage to undergo a form of quarantine procedure. Discharging these measures effectively has always required the closest collaboration between H.M. Customs and the Port Sanitary Authority.

The authorities were also made responsible for the provision of adequate means of transport and isolate infectious patients as well as the immediate contacts who were to be detained for a period of medical surveillance. They were obliged to make available a steam disinfector installation to sterilise infected bedding and articles of clothing, and possess equipment to disinfect the appropriate spaces aboard ship.

Briefly, it was the responsibility of the Port Medical Officer to determine the nature of any disease and arrange for the hospital treatment and surveillance; whereas the Port Sanitary Inspector, acting directly under his instructions, was responsible for the movement of the patient, contacts, bedding, etc., and the disinfecting of the infected accommodation. The Sanitary Inspector had the additional responsibility of controlling nuisances and conditions prejudicial to health ashore and afloat and of inspecting imported food as occasion required. In this connection and for the purposes of the Public Health Acts, a ship must be considered a house and the Master as the Occupier, proivding the vessel is not in charge of an Officer bearing H.M. Commission or is the property of a foreign government.

(b) **Additional Responsibilities.**

With the course of time, the statutory provisions were changed and the range of activity increased. Legislation relating to rats and mice, handling and transport of meat, preservatives in food, control of shellfish, all added to the duties of Port Sanitary Authorities. A significant international movement culminated in the signing and ratifying by no less than forty-four countries of the International Sanitary Convention, 1926, whereby Port Sanitary Authorities were committed to a more vigorous participation in the control of rats, particularly aboard foreign-going ships. In order to give further effect to the Convention and consolidate certain other regulations in force at the seaports, new regulations known as the Port Sanitary Regulations, 1933, to be exercised by all Port Sanitary Authorities in the United Kingdom, were introduced. Subsequently, there came into being the Public Health Act, 1936, to bolster public health from the national aspect and it will be particularly identified as the Act which changed the designation of the Port Sanitary Authority to Port Health Authority.

While these variations were in progress, another important change in transportation was taking place. The volume of air traffic was intensifying and in the year 1933 a comparable code of practice was drafted at a Convention and presented for signature at the Hague. Unfortunately, only a few countries, including the United Kingdom, appended their signatures to this Aerial Navigation Convention, 1933, which set the pace for public health control at the airports.

II. Port Health Authorities

Whatever the significance in the change of title as far as seaports are concerned, this change did occur at a time immediately preceding a distinct improvement in the influence and activities of the Port Health Authorities. The labours of the past, added to the increasing pressure of the times, brought fresh rewards. Whether or not attributable to the zealous efforts of Port Health Authorities, but certainly to their influence, there was a particular revival of sanitation consciousness in the British shipping industry which is still very much in evidence to-day and has provided seafarers with living and sanitation conditions that contrast enormously with those of the not very distant past. Appropriate improvements have developed simultaneously in connection with port installations, although the stages of advancement may vary considerably from place to place.

In the sphere of food inspection, the regulations which became operative in 1937 have proved very useful in spite of some limitations. Subsequently, the legal provisions appertaining to pest control and the new health regulations applicable at the seaports and airports, enabling effective interception of diseases associated with international travel, have strengthened further the organised health defensive measures.

(a) **Legal Aspect.**

Quite apart from local by-laws, the main functions are governed by legislation for preventing the importation and spread of infectious diseases, controlling nuisances and other conditions prejudicial to health, examining imported foods destined for human consumption, preventing damage by rodents and control of shellfish layings. Medical inspection of arriving aliens is added to these by arrangement with the Home Office.

(b) **Practical Application.**

Since there are 91 Port Health Authorities in the United Kingdom, it is to be expected that there should be some variation in the application of Regulations at the seaports and airports according to local circumstances and the overall significance of the port. This does not imply any statutory modifications or complacency, but simply the wisest application of the provisions as are required, depending on the nature and magnitude of the trade of the port. Variations can also arise from the constitution of a Port Health Authority in so far as an authority may represent a number of Riparian Authorities that share in the responsibility of imported food inspection or it may be a port health district of a Local Authority, or as in the case of London, it may have jurisdiction within districts detached from the City of London.

Nevertheless, every effort is made to fulfil the legal requirements according to circumstances, although it must be conceded that there is some lack of uniformity in doing so. The basic principles, however, are clearly understood by all.

In addition, there are those commitments which necessitate the closest collaboration with the Home Office, Ministry of Transport and Civil Aviation. H.M. Customs, Ministry of Health, Ministry of Agriculture, Fisheries and Food, and Trinity House Brethren.

(i) **Ship Medical Inspection.** As a ready guide to Port Medical Officers, the World Health Organisation issue a confidential Weekly Record of Quarantine Diseases regarding the prevalence and the distribution of the quarantinable diseases — plague, smallpox, cholera, yellow fever and typhus fever — throughout the world, thus alerting Port Health Authorities to meet any arrivals from the "infected" or "suspected" areas.

Accordingly, certain formalities have been introduced for foreign arrivals in normal circumstances and particular care is taken of the arrivals from the recorded areas or where it is understood that there is a case of illness even resembling the symptoms of a major communicable disease from any area. No time is wasted nor effort spared in taking effective measures to ensure the interception of quarantinable disease with a minimum of delay to shipping. To this end, a ship may be boarded at sea and operations begun well in advance of arrival at the seaport. This procedure, in the case of smallpox, for instance. would require medical inspection and all protective measures to be adopted, certain clerical routine and the arrangement of facilities at the port for the prompt reception and transfer of the patient, contacts and bedding. Such procedure must be completed in readiness to enter the port and in time to advise the Medical Officers of Health of the various districts, to which the remaining passengers and crew are destined, of the circumstances and the need of personal surveillance during the particular incubation period. Especially in this respect,

The Port Health Authority—*continued*

co-operation between Local Authorities and Port Health Authorities is absolutely indispensable.

All ships that have called at an " infected " or " suspected " port during the previous four weeks, should be boarded by the Port Medical Officer or the Inspector.

(ii) **Ship Sanitary Inspection.** After qualifying for " pratique," the ship normally proceeds to the terminal berth and henceforth receives the attention of the Port Health Inspector. His visit should be timed to make his enquiries and observations as early as possible after the ship has been secured. By so doing he is able to assess day to day conditions undisturbed, some of which are key points of the inspection; besides, time and decision are important factors with which he must reckon. As a " house " the ship is inspected to cover all domestic problems involving environmental health. Unlike his counterpart ashore he is not empowered to demand structural alterations; he does advise but the ultimate decision may rest with the Ministry of Transport and Civil Aviation which holds this prerogative. Otherwise, defects and deficiencies in the standards prescribed for living accommodation can be dealt with at once, as well as nuisances arising from neglect or pest infestation. In general terms, his responsibility covers the well-being in health of the crew with the exception of the food stores, very odd though it may be. Outside the accommodation, other health factors must be considered, including drinking water storage, refuse disposal, smoke abatement and rodent control to meet the international and national obligations, which includes the systematic deratting of ships and the examination of specimens for evidence of P. pestis. Such precautions, whether afloat or ashore, are complementary in the defence of national health.

It is imperative that the smaller craft of the port should receive consistent attention for nuisances. Action must be directed especially towards exterminating rodent infestations aboard barges, since any colony may comprise specimens from various ships and these are ferried from place to place so constituting a reservoir for spread of plague. Other small craft include canal boats and houseboats, both of which need regular sanitary inspection and powers to do so are provided in the Public Health Act, 1936, and in local bylaws.

(iii) **Shore Sanitary Inspection.** In the broadest sense the Inspector's duties resemble those of any urban district colleague as far as the allotted Sections of the Public Health Act, 1936, permit and pests are to be controlled. Quite naturally there are some features of the task that are peculiar to docks and wharves, but the principles of sanitation are universal. Here again the international commitments must be acknowledged; the Port Health Authority must subdue any reservoir of disease vectors in the district, thereby taking account of rodents and mosquitoes.

Not least among the health precautions taken is the investigation of the drinking water supplies. Since foreign-going ships replenish their water storage tanks from supplies at various foreign ports and because this drinking water is available to all who board the ships, it is a desirable practice to take routine samples with reasonable discretion and submit them for examination. Routine samples are taken to check port fresh water supplies to the ships, some from licensed waterboats and others from the quay hydrants, to ensure the health of the seamen and thus the operational efficiency of the outward bound ships.

Refuse collection points need and get considerable attention, as also does the disposal equipment. A fair proportion of the refuse from the ships consists of putrescible matter from the catering department and this provides attractive feeding for rats; open dumps, therefore, are to be deplored and nothing less than suitable mobile containers, distributed over the port and at a convenient distance from the ships, should be accepted if pests and nuisances are to be discouraged.

(iv) **Food Inspection.** This branch of the port health organisation is, in some respects, more spectacular, probably because decisions immediately reflect on a complex system of food marketing and national distribution, to mention nothing of the financial interests. A very large amount and an increasing variety of foods for human consumption pass through the ports and, although inspection practice recognises and adopts the generally accepted standards, some knowledge of stowage and transportation complications is a distinct advantage when arriving at a conclusion in the restricted time at the Inspector's disposal, particularly when dealing with perishable commodities such as fish, fruit and meat.

Formal action can only be taken after the foods have been given a clearance by H.M. Customs and the examinations are preferably carried out simultaneously as a measure of expediency. It is customary to make a token detailed examination, then support it by an overall superficial inspection of the consignment. Furthermore, sampling has become the more important on account of the various suggestions to introduce antibiotics and anti-oxidants as preservatives.

Without any suggestion of prejudice towards the exporting country and trade practices, the Inspector must be unrelenting in vigilance and resist any tendency to complacency. Even documents or certificates should not always be accepted as bona fide evidence. There is provision in the Regulations for detention and seizure which is taken into good account, but the short time limit of 48 hours detention could be embarrassing failing the goodwill of the importer.

(v) **Shellfish.** Imported shellfish are submitted to the same careful inspection as any other article of food, but those developed in home waters are controlled on different lines with the same objective. The Port Health Authority has jurisdiction over the layings within the district and requires that shellfish gathered by traders for human consumption from " prescribed areas " shall be subjected to a process of cleaning or sterilisation by steam cooking according to type. Bacteriological examination of the final products is essential and reference is made to the standards laid down by the Worshipful Company of Fishmongers and the Ministry of Agriculture, Fisheries and Food. The type of sterilising plant must be approved by the Port Health Authority and frequent inspections are made to ensure that the correct procedure is being maintained.

(vi) **Additional.** It is anticipated that additional scope for port hygiene will be given in the near future when regulations are made to control dark smoke emissions and food hygiene in harbour vessels. The merits of each have claimed much attention already and will receive the close attention they deserve. In regard to smoke abatement, some difficulty will surely arise at the outset since international shipping is involved, some sections of which have inferior installations and may be obliged to bunker inferior quality coal according to circumstances. However, bridges cannot be crossed until they are met.

III. Conclusion

In this Paper, it has been the author's intention to outline the development of the Port Health Authority as it is known to-day. The imagination and wisdom of the British Government and the pioneers of environmental health alike have been recognised and tribute extended to those who shouldered the mounting responsibilities of port sanitary authorities.

In making contrast with the present day organisation and the high degree of security enjoyed by the nation against imported infectious diseases, there must develop a deep sense of gratitude towards those who have contributed to this victory over the centuries and no less to those even of recent years.

To consider any more than the main functions of port health activities has not been possible, but it may be freely accepted that there are minor duties and moral obligations involved also.

Both seaport and airport health authorities share a common task and can be considered as " sound insurance investments " for the protection of national health. The amazing expansion, popularity and ramifications of international travel and commerce has drawn countries, otherwise distant, much closer together, reducing the time factor proportionately with the effect of hazarding security on incubation period calculations.

An outstanding feature of the larger port health authority activity is that international flavour and commitments are so interwoven that it can be very difficult to divorce the national from international obligations. The field of interest has grown to include health, welfare and education regardless of nationality and, in this pursuit, no mean share of the credit is due to port health authorities for the various spectacular improvements which have overtaken the unhealthy conditions of the past in which seafarers had to live. Their influence has made its impress upon parallel conditions within the ports also.

The Ports of South Wales

5. The History and Development of Port Talbot Docks

(Specially Contributed)

PORT TALBOT DOCKS, approximately eight miles to the east of Swansea, are situated on the estuary of the River Avon and replaced a natural harbour which had been the scene of maritime trading for many centuries.

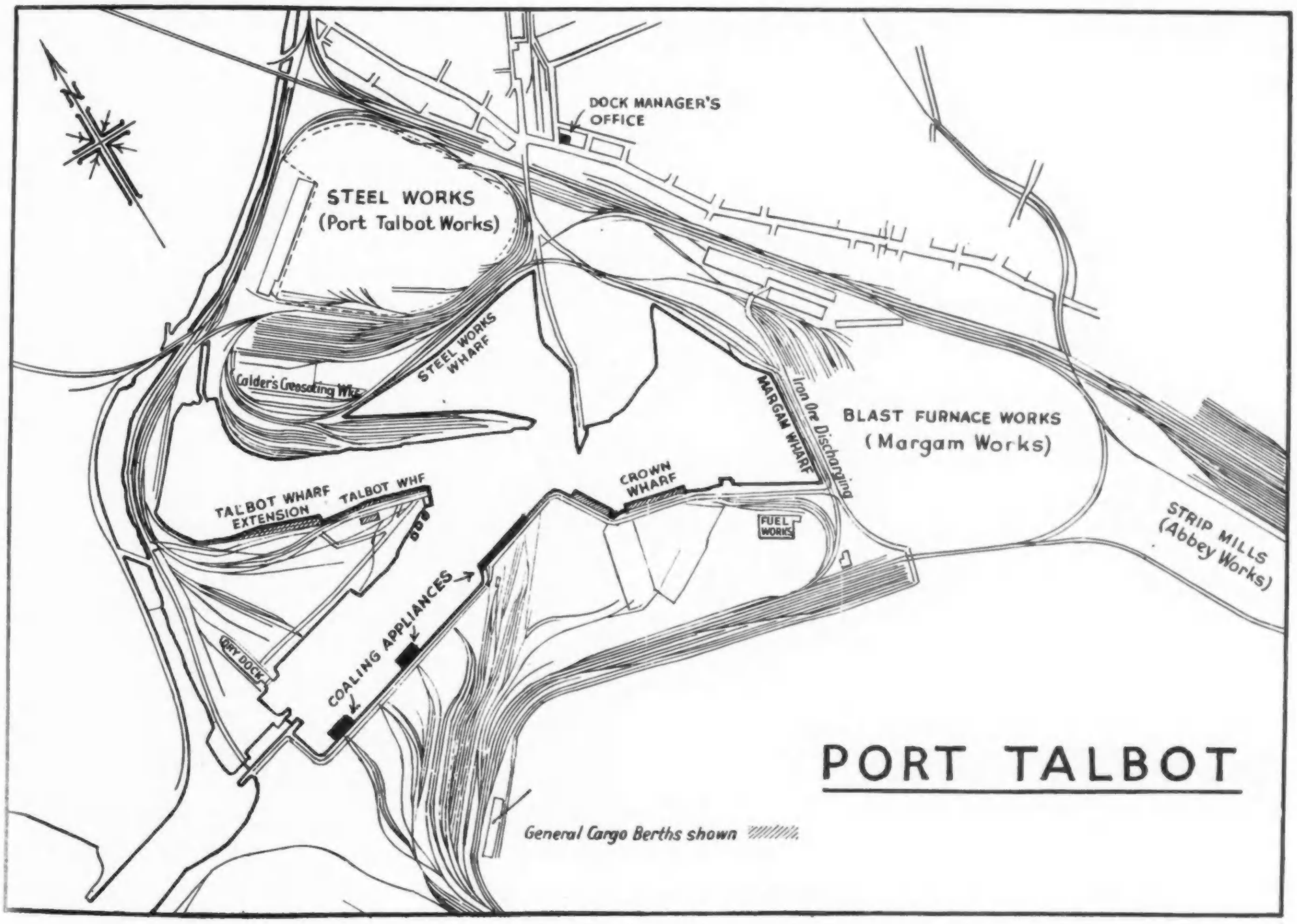
The earliest available records relate to the shipment, by the monks of Margam Abbey, of wool and corn to Continental ports as early as the 12th century. This trade continued without much alteration until the 17th century when, in the year 1697, the first record is found of the shipment of coal, which was to develop into one of major traffics of the Port. At that time the coal was brought from the neighbouring mines by pack horses, mules and carts, but in 1757 the first tramline was laid from nearby Cwmavon to the river wharves where the coal was shipped over wooden coal drops. A few years later the first Copper Works was erected, at which Copper Ore imported from Cornwall was smelted with coal from the Avon Valley. In 1811 another new traffic was attracted through the Port as a consequence of the establishment of an Iron Works at Cwmavon, with the resultant demand for the importation of Iron Ore and exportation of the finished product.

The trade of the port then grew rapidly, particularly the export of coal, and it became evident that the then existing wharves were not capable of handling the potential tonnage offering. In consequence a Bill was promoted and an Act passed in 1834, under which the Aberavon Harbour Company was incorporated for the purpose of improving the Port and Harbour of Aberavon and the entrance channel thereto. In 1836 a further Act was passed, amending the title of the Company to "The Port Talbot Company" and the name of the harbour to "Port Talbot." Under this Act the Company were authorised to divert the course of the River Avon, to use the old bed of the river as an enclosed dock, and to construct an entrance lock, thus providing deep water accommodation alongside quays quite independent of tidal conditions.

Opening of Dock.

By 1837 all the authorised works were completed and the dock was opened. The port facilities proved adequate for a period of over fifty years, but in 1890 further improvements were necessary to cope with larger vessels, and to take advantage of the ever expanding coal trade. A public company was promoted and in 1894 an Act was passed dissolving the Port Talbot Company and incorporating the "Port Talbot Railway and Docks Company." This Act authorised an extension to the dock, the construction of a new lock, piers, and a number of railways to link up with the neighbouring coalfields.

Most of these works were completed by 1898, and the port became one of the principal coal exporting centres in the Bristol Channel. By virtue of its favourable position on the edge of the western and central portions of the South Wales coalfields, the export of coal increased steadily up to the outbreak of war in 1914,



Port Talbot—*continued*

Port Talbot Docks, looking south.

when over 2,000,000 tons were being shipped annually. The impact of war and the subsequent years of readjustment did not affect the coal trade of Port Talbot so adversely as was the case with some of the other South Wales ports, and a reduction between the years 1917 and 1921 was followed by a recovery in 1922 and the achievement of a peak figure of over 2,700,000 tons in 1923. Even after the world-wide slump in trade in the early 1930's, Port Talbot maintained a coal export in the region of 2,000,000 tons annually until the outbreak of war in 1939.

During the war years the coal trade assumed lesser importance, while the tonnages of miscellaneous traffics handled increased greatly, the Port bearing its full share of the impact on the South Wales Ports of the East to West Coast diversion of shipping. Much local speculation was aroused during the construction of units of the "Mulberry" Harbour, used in the Normandy landing, whilst another unusual sight for a short period was an encampment in the Docks area of the renowned Free French troops from the Lake Chad district in North Africa.

Post War Developments.

Despite the recession in coal exports, the post war years have produced a steady improvement in the general prosperity of the Port, mainly due to increasing importations of Iron Ore. As previously mentioned, this traffic first appeared in 1811, and it has continued as a regular feature since that date, the pre-war imports reaching a maximum of 456,000 tons in 1937. During the latter part of 1947 the Margam and Port Talbot Works of Messrs. Guest Keen & Baldwins Limited, were incorporated with a number of the Tinplate works of the Richard Thomas & Baldwins group, the Llanelly Associated Tinplate Manufacturers Limited and John Lysaght Limited into the Steel Company of Wales. This great undertaking has constructed the largest and most modern plant in Europe for the manufacture of steel. The works are located to the eastward of the Docks, and their establishment has given a tremendous impetus to the importation of Iron ore, which reached a total of nearly 1,700,000 tons in 1956. It is anticipated that the annual importation will reach 3½ million tons when full development is completed. In order to cope with these increased tonnages the Margam Wharf (which is the main Iron Ore Wharf) has been extended, and the two original transporter grabs replaced by four modern transporter grabs with a conveyor system from ship to stock pile or works. By means of this equipment a speed of discharge of 1,000 tons per hour has been achieved. A subsidiary, but none the less welcome, addition to the trade of the port, is the increasing quantities of steel sheets for export.

The British Transport Commission has actively participated in encouraging the post-war prosperity of Port Talbot. In 1952, a new 11 KV Ring Main was installed to afford additional and improved electricity supply at the docks, at a total cost of £36,000. In that year also, the erection of a new Impounding and Hydraulic Pumping Station was completed at an expenditure of £100,000. This station comprises three electrically-driven impounding pumps of 22,000 gallons per minute capacity, and five electrically-driven hydraulic pumps with capacities of 350 gallons per minute.

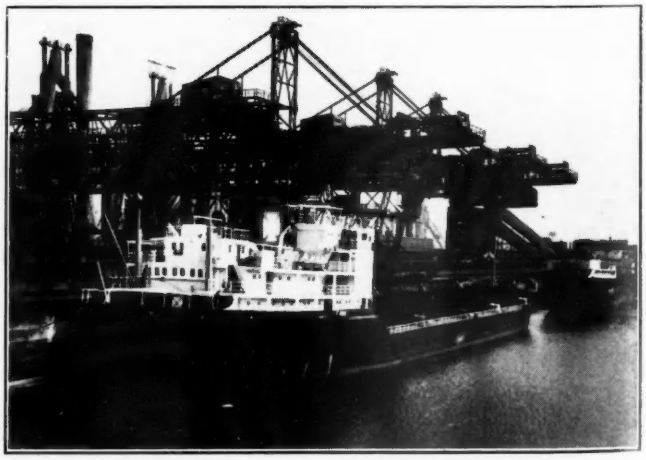
New lockgates of welded steel construction have been ordered, together with new lock gate machinery. The new gates will replace the existing ones which will be overhauled and held as spares for use in case of emergency. A slipway is to be constructed adjacent to the Lock in the Channel Entrance to accommodate the spare gates, so that these can be readily accessible in case of need. A new Dolphin is also to be provided in the Entrance Channel to take the place of the two existing Dolphins, which have reached the end of their effective working life. The estimated cost of all these improvements at Port Talbot is over £150,000.

To meet the needs of the bulk import trade, an expenditure of £175,000 has been authorised on modernising the cranage facilities at the Talbot Wharf Extension; this includes the provision of four 10-ton electric portal grabbing cranes, a new crane track, additional electricity supply and improved road access.

To improve the dredging operations in the entrance channel, a new grab dredger was purchased in 1954 at a cost of £135,000. This vessel, which was designed by the Commission's Engineers, is a single-screw diesel-propelled twin grab hopper dredger. It has a unit operating cost of about half that of other dredging craft employed at South Wales, and has been designed specially to deal with the particular needs of the port.

Changes in Administration.

Since the original proposal to construct a Dock by the Aberavon Harbour Company, there have been four changes in administration, first to the Port Talbot Company which took over shortly before the opening of the Dock, and secondly to the Port Talbot Railways and Docks Company in 1894, when the reconstruction of the Port was under consideration. Under the Railways Act, 1921, this Company was absorbed by the Great Western Railway who continued as the Port Authority until 1948, when the railway-owned Docks were nationalised and came under the management of the British Transport Commission.



Iron ore transporters, Margam Wharf, Port Talbot Docks.

Port Talbot—continued

The Port To-day.

The entrance channel is maintained to a depth of 30-ft. 9-in. at M.H.W.S.T. and 23-ft. M.H.W.N.T. by the modern Dredger previously referred to, with the occasional assistance of one of the Commission's Bucket Dredgers; the amount of material dealt with annually being in the region of 300,000 cubic yards. Owing to the considerable range of tide, dredging is carried out on a day and night tidal basis, involving the crews living aboard. V.H.F. wireless communication is provided between Dredger and Shore. Sluicing is carried out at Low Water of Spring Tides and is found to be most effective in clearing the comparatively short entrance channel.

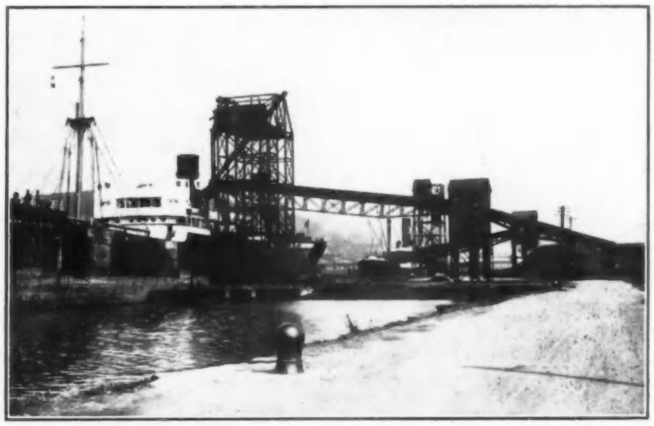
The entrance Lock is 450-ft. long by 60-ft. wide, with a 50-ft. wide "Lay-by" on one side to allow more than one vessel to be dealt with at the same time.

The Docks have a total water area of 123 acres, of which 74 acres are maintained at a minimum depth of 27-ft. 6-in., and the total quayage amounts to over two miles.

Immediately adjacent to the Entrance Lock and on the South Side of the Dock are the coaling berths where four modern appliances are sited, each capable of dealing with 20 ton wagons. Two of these appliances are Hoists, by means of which the wagons of coal are raised to the required height and the contents tipped via the chute into the ship, whilst the other two appliances are of the conveyor-belt type, especially suited to the shipment of the various types of small coals which are a prominent feature of the present day coal shipments at the Port. Both these latter appliances are fitted with mechanical spades (known as "Norfolk Diggers") to facilitate the clearance of wet or frozen small coals from the wagons. At the rear of the coaling appliances are extensive sidings for the storage of coal awaiting shipment.

General cargo of all descriptions is handled at four points within the Docks—Crown Wharf, Steelworks Wharf, Talbot Wharf and Talbot Wharf Extension. Although the major traffic of the port is the importation of Iron Ore a wide variety of general merchandise is handled, including Sand and Gravel, Pitwood and Mining Timber, Sleepers and Poles, and Chemical Fertilisers.

Ship-repairing facilities are provided by the Prince of Wales Drydock Company (Swansea), Ltd., whose Drydock is 460-ft. in length with an entrance of 60-ft. A lay-by berth of 350-ft. by 50-ft. within the Drydock permits of two vessels being repaired simultaneously.



Coal shipping belt conveyor, Port Talbot Docks.

Situated within the Docks estate is a Patent Fuel Works, operated by the National Coal Board, at which Briquettes are manufactured for inland consumption.

Many other smaller works ancillary to the trade of the Port have their premises within the Docks area, including the modern repair shops of Wagon Repairs Limited.

Excellent road and rail access is provided to all parts of the Dock, and extensive open storage is available.

The growing prosperity of the Port in post-war years is well illustrated by the increasing tonnages passing each year. In 1945 the total tonnage of imports and exports amounted to 620,000 tons, whilst in 1956 this had risen to 2,400,000 tons. The continued development of the Abbey and Margam Steelworks, combined with the vigorous expansion policy of the British Transport Commission, augers well for the future of Port Talbot Docks.

Annual Report of Bootle Fire Brigade

Efficient Co-operation at Port of Liverpool

The ninth annual report of the Bootle Fire Brigade, which includes in its district the Port of Liverpool, was published recently.

A review of the year's operations shows that although many of the fires attended in the Borough could, on arrival of the Brigade be regarded as presenting unusual hazard due to the commodities involved, none reached major proportion, mainly due to prompt calls and response coupled with weight of attack employing modern machines and equipment.

The constant need of the Brigade in terms of highly trained manpower, machines and ancillary gear with its resultant heavy demands upon the public purse is considered to be fully justified by the evidence of the past three years' operations during which the risk at stake, that is to say actually affected by fire, has amounted to a fantastic figure which although not accurately accessable in total, involves many millions of pounds sterling. Due to efficient fire attack the loss, whilst in some cases severe, can over this period be assessed monetarily in thousands only. These figures may suggest some exaggeration but the following facts are indisputable, during the past three financial years, taking into account ship fires only, the aggregate gross tonnage involved in fire was 860,000, with an estimated replacement value considerably in excess of £100,000,000, whilst the value of the cargoes involved is additional and impossible to estimate. Apart from the example given, property affected by fire embraced premises with very high replacement value and stock at risk ranged from dock warehouses, transit sheds, timber yards and storage depots, to large factories and industrial undertakings.

Fire Prevention Organisation

Although an excellent liaison has been built up over a period of several years between the Brigade and industry and commerce within the Borough, this liaison has, unfortunately, often required to be fostered by the incidence of fire, or through legislation covering public safety. It would appear that the Fire Prevention Service is still viewed with a certain amount of apathy by sections of the community who retain the mistaken idea that Fire Prevention is an expensive luxury. Such people do not realise the value of this expert advice which is designed not to incur expenditure but to ensure that fire risk, and indeed life risk, is minimised. The old adage "Prevention is better than cure" is very appropriate when applied to fire wastage. Fortunately, internal liaison embracing the several departments of the local authority ensures that the Brigade is consulted on plans of new building work, adaptations and on certain aspects of planning when it is intended to allow the introduction of hazardous trade processes into the Borough.

Places of Public Assembly are visited regularly and the full support of the Licensing Bench assures that the high standard of public safety necessary is maintained.

Lectures and training are given to members of local firms in fire prevention and first aid fire fighting whilst local organisations are encouraged to interest themselves in the work of the Brigade and make visits to the Central Fire Station to see the organisation and equipment which this authority is called upon to provide.

In reverse, members of the Brigade continue to make organised

Annual Report of Bootle Fire Brigade—continued

View of fire on s.s. "Explorer," showing the need for breathing apparatus.

visits to industrial premises resulting in an increased knowledge of the risks in the Borough and the hazards likely to be encountered by the Brigade in the event of emergency.

Comment must be made on the excellent co-operation existing between the Mersey Docks and Harbour Board, the Shipping Concerns and the Brigade. Advice offered by the Brigade is invariably accepted and necessary action taken, the year under review showing that although actual incidence of fire in ships in port shows a decided increase (34 calls as against 11 for the previous year) only two ship fires could be classed as major incidents (s.s. "Naturalist" and s.s. "Explorer") and due to the organised action of all concerned damage was minimised although both ships were seriously affected on the arrival of the Brigade. In this regard it is of interest to make reference to the Annual Report of the Liverpool Underwriters' Association which quotes "... the relatively low incidence of serious ship fires on Merseyside may be attributed in some measure to the appreciation of owners, masters and crews of the value of (1) efficient fire precautions, (2) advice from local authority fire brigades, and (3) an immediate call to the fire brigade when a fire is observed or suspected."

The training of the Central Fire Station of ships security patrols has been continued during the year and although it has not been found practicable to train the numbers originally visualised, it is considered that this training, apart from the benefit to the individuals concerned and, therefore, their employers, does much to encourage efficient fire protection.

The joint Police/Fire Brigade Radio Scheme continues to operate effectively and the introduction of radio has proved an invaluable aid to the smooth and efficient operation of the Brigade.

A total of 139 high risk premises are linked directly to the Central Fire Station Control panel by G.P.O. Private Wires and Automatic Alarm Systems and further installations are now in progress.

Factors Influencing Traffic through British Ports

Discussion at Annual Conference of the Institute of Traffic Administration

The annual conference of the Institute of Traffic Administration opened on Friday, October 4th last at the Walton Park Hotel, Clevedon. Mr. R. P. Bowyer presided at the first session in the absence of Lord Merrivale, the President. Mr. Bowyer is the Institute's senior Vice-President.

The opening session was devoted to a discussion on the factors influencing the flow of traffic through British ports. The first speaker was **Mr. H. Leat, Chairman of the Institute of Shipping and Forwarding Agents,** who said that members of his institute were users of transport who were concerned with routing traffic at an economic but not necessarily the cheapest cost. Many factors came into the picture, and dock charges and service were among the most important.

The Port of Bristol some years ago made a film showing the activities of the ports of Bristol and Avonmouth. Seeing the film again after a number of years, Mr. Leat said he was struck by the change in the pattern of the flow of traffic in such a short time. A large portion was handled by liners running in Conferences, and whatever criticism might be levelled at these bodies it had to be remembered that they stabilised freight rates thus enabling forward business to be conducted with a degree of certainty not attainable by other means. No Conference held a complete monopoly in a trade—shippers could make their own arrangements provided they had sufficient cargo to attract a tramp vessel. This was, of course, subject to the variations of the international freight markets.

Most of us, said Mr. Leat, had lived to see the change over to the handling of grain in bulk by machine. There was no more Australian wheat, Chilean barley or linseed in bags. Now sugar in bulk figures prominently, and a special vessel has been built in Denmark to carry cement in bulk. Liquids of all kinds and gas also figure in bulk carrying vessels. The provision of the bulk carrying vessel is only one link in the chain, terminal facilities have to be provided at high capital outlay. Some of the special vessels are also more expensive to build, but the rapid handling of cargo should offset these additional costs.

All this presupposes units on a larger scale even to the extent of continuous manufacturing processes. When these could operate for 24 hours a day for months at a time, the optimum efficiency could be attained. What a pity it was that with vast sums of money invested in our national dock undertakings they only worked a nominal third of the day. At the port of Newport it was possible to work two or three shifts in the day; extra payments were involved but nothing like the sums that would be involved on the south side of the Bristol Channel. This is a matter deserving study; apart from making better use of capital equipment, the larger labour force concentrated on one vessel is employed to better advantage. This in turn reduces the time of the vessel in port, a most important factor in the calculation of freight rates where owners work on the cost of maintaining their vessel per day. Owners will often avoid a port on the ground of poor despatch rather than high port charges.

Such ideas as suggested above would no doubt bring opposition from the Trade Unions who seem more interested in securing the maximum wages for their members than in helping the national economy by speeding the turn-round of ships. One can look in vain for any constructive proposal on this subject at a labour conference. No thought ever seems to be given to the fact that someone has to pay for wage increases. There is such a thing as pricing oneself out of a market, and this is becoming plainly evident. Up to 1935 five vessels were engaged in regular general trade in the Bristol Channel moving over 1,000 tons per week. The sheer weight of operating expenses forced them to close down. The same tendency is appearing in the short sea trades as evidenced by the growing use of containers, coupled with drive on and drive off facilities for sea transit.

The railways already offer such facilities with their train ferries and traffic even from the Bristol area can rapidly be attracted by these routes. It has been said that time is the essence of any contract, and considered in conjunction with the value of the commodity provides an essential factor in transport.

We have decasualisation of dock labour—a good organisation

Factors Influencing Traffic through British Ports—continued

for a regular labour force and ensuring the payment of income tax —but at the cost of an increase in dock handling charges, to say nothing of delays when the labour force is not adequate. Delays represent loss not only to shipowners but to every owner of capital equipment that is not being used.

It looks as though important steps will have to be taken in the sphere of transport to ensure our economic survival. The movement of merchandise is at the foundation of our living standard to-day. The proposals for the European Free Trade Community are obviously steps in the right direction, let us hope dock charges do not negative any of the benefits that might accrue.

The Influence of Port Charges

The Second Speaker was **Mr. F. D. Arney, General Manager of the Port of Bristol,** who said that Port Charges could greatly influence the amount of traffic passing through a port. This was reflected by the fact that ship owners operating in conference did not operate the same freight rates in every port that they used.

The facilities provided varied in different ports, for example, some ports made themselves responsible for loading goods onto rail whereas in others they only unloaded on to quay.

The effect of road haulage rates is considerable and rates to ports at the same distance from, for example, a given factory, might be different owing to it being easier for the haulier to obtain a return load from one than the other.

An important factor was frequencies of shipping. A manufacturer dealing in import and export might have his own fleet of lorries in use for home distribution as well as for taking goods to port for export. If he found that the frequency of sailings from one port was better than another, he would tend to use that port, both for export and import so that he could more easily arrange the return loads for his vehicles.

Frequency of sailings meant a lot to the primary producer who had to wait for payment for his goods until they were delivered. Small differences in port dues could be balanced by earlier payment for the goods resulting from an earlier sailing.

Port Authorities were statutary undertakings and could only be set up with the authority of Parliament and were in effect nonprofit making organisations and with the exception of the Manchester Ship Canal Co., there was no dividend payable to shareholders.

Port charges were composed of different elements, the first of these being statutory charges which were, for the most part, the dues on the ships and on the goods themselves. The dues on the ships were assessed on the basis of Nett Registered Tonnage which was a measure, in fact purely fictional, of the carry capacity of the ship. Charges were under the control of Parliament which laid down that a Port Authority could not favour one shipper as against another in respect of rates. Dues on ships were assessed on the frequency of their visits to the port and that was determined largely by the part of the world from which the ship sailed.

The fact that after a rate had been approved by Parliament it was only possible to vary it upwards by 25 per cent. without further application to Parliament was a severe restriction on the ability of a port to quote competitive rates. Furthermore every payer of dues had the right to appeal to the Minister of Transport if he thought they were unreasonably high and the Minister was bound to take the matter up with the Port Authority and if necessary order a public enquiry to assess what would be a reasonable rate.

It was, however, possible for a Port Authority to vary the element in the rate based on labour charges in order to quote competitive through rates and this was frequently done, since it was the through rate which interested the customer.

The special constitution of the Port of Manchester Authority which was a limited company and a member of the Railway Clearing House Association and had a complete monopoly of all operations in the Port of Manchester placed it in a specially favourable position to compete with other ports through its ability to quote through rates to every Railway Station in the country. A result of this was that the Port of Bristol could not compete with the Port of Manchester for traffic from the Midlands and points lying anywhere approximately between.

The Trade Unions had an important influence on labour charges, and if some of the restictive practices prevalent in dock operations could be removed charges could be reduced and more efficient use made of port equipment. Incidentally the position in this respect in Bristol is better than some other ports.

To make the fullest use of dock installations it was necessary for shift work to be introduced. This, however, would need the co-operation of hauliers, warehousemen, and customers generally to ensure a steady flow of traffic and avoid bottleneck. It would be necessary, for example, for hauliers to be able to collect and deliver goods at factories out of normal working hours. The standard of living of the country depended on its being able to stand its exports and it could only do this if the equipment in the ports were used to the full.

Suggested Improvements along Potomac River

Recommendations by Virginia State Ports Authority

The Virginia State Ports Authority recently completed an extensive technical survey entitled "Report on the Potential for Waterborne Commerce on the Potomac River at Alexandria and Washington." A number of recommendations for enlarging the port facilities at Alexandria and Washington have been made and the results of the survey have been placed before the appropriate United States government agencies. The Potomac River is normally open to navigation throughout the year.

The report recommends the construction at Alexandria of modern terminal facilities for passengers and cargo and that the Potomac channel be deepened to 36-ft. and widened to 300-ft., with extension of the turning basin to accommodate large liners. The existing draft limitation on the Potomac River is 22-ft., which. although deep enough for fairly large ships with part cargoes for discharge at Alexandria, is shown by the report to be inadequate for the substantial traffic potential of the area. The recommended channel improvements would permit about 90 per cent. of the existing shipping tonnage of the world to have access to the Alexandria-Washington area and its important hinterland with a population of several millions.

Map showing Alexandria-Washington area and hinterland.

The Alexandria waterfront is described as the best in the area for deep-water terminals because of its location, convenience to rail, road and air transportation, availability of frontage, ware-

Suggested Improvements along Potomac River—continued

house and transit shed space, and space for waterfront development and nearby industrial growth.

After reviewing the early history of Alexandria as an important port, and of the Potomac River as a travel artery, the Report points out that the population of the Washington metropolitan area increased almost three-fold since 1930, the second largest growth of any area in the United States. Family income in this area is amongst the highest in the nation, and the geographical location of Alexandria is not only adjacent to the Washington metropolitan area, but is extremely well situated in relation to the centre of gravity of the United States population and industry.

The National Airport, Washington, one of the busiest in the world, is located at Alexandria, within easy reach of the waterfront area recommended for development for ocean and coastwise shipping.

Despite its growth and its high traffic and income potential, the Washington metropolitan area is the largest in the world situated on tide-water which is lacking in adequate deep-water navigation services. Besides benefiting present shippers and consumers in this area, the Authority predicts that a deep-water channel "would probably lead to the industrialisation of the Potomac River areas below Alexandria-Washington, which would provide a substantial source of income and wealth for the region."

In any country with a population growth as rapid as that taking place in the United States the availability of centrally located industrial sites on deep water is of vital importance to insure a rational development of commerce, including development of the distributive trades.

Total waterborne traffic on the Potomac in 1955 amounted to 6,390,365 tons. This comprised 3,683,784 tons of receipts and 2,706,581 tons of shipments, both foreign and domestic. Petroleum products constituted 95 per cent. of the total imports, and 87 per cent. of the shipments.

To determine the general cargo potential through Alexandria-Washington (assuming that there will be an adequate channel for ocean-going vessels, satisfactory steamship services, inland rates, port facilities, etc.) the Virginia State Ports Authority sent a questionnaire to about 3,000 business firms in Washington, D.C., Northern Virginia, Northern West Virginia, Western and Southeastern Maryland, and Southwestern Pennsylvania to ascertain (a) which firms are engaged in the exporting, importing and intercoastal trades, (b) the tonnage of specific commodities handled, (c) foreign areas traded with, (d) U.S. ports used, and (e) U.S. place of origin or destination of shipments.

The questionnaire returns indicated that, on the assumptions stated in the preceding paragraph, 248 firms might export 91 different products from Alexandria-Washington, with an annual general cargo tonnage of 546,458 tons; 176 firms might import 81 different products at Alexandria-Washington, with an annual general cargo tonnage of 504,665 tons; 172 firms might ship 67 products, with a yearly general cargo tonnage of 198,249 tons, from Alexandria-Washington to the U.S. West Coast; and 207 firms might ship 68 commodities, with a general cargo tonnage of 1,382,139 tons annually, to Alexandria-Washington from the U.S. West Coast.

Developments regarding the opening up of the Potomac River and of Alexandria-Washington area to world shipping will be watched very carefully by European maritime interests, particularly by importers and exporters to whom transportation costs so often represent the marginal factors determining their ability to compete in the foreign markets.

Personalia

Appointments

Mr. J. R. Proudfoot, general manager and secretary of the Leith Dock Commission has been appointed general manager and secretary of the Clyde Navigation Trust in succession to Mr. John Wilson, who has held these positions since January 1st, 1935, and is due to retire in April next year. The appointment was made by the Trust on a unanimous recommendation from their general purposes committee following a report and recommendation by a sub-committee.

Mr. Proudfoot, who is 57, has been general manager and secretary of Leith Dock Commission since 1949. He was educated at George Watsons's College and Edinburgh University and joined the staff of Leith Dock Commission as assistant to the collector of rates in January, 1925. He succeeded the collector of rates in 1929, was appointed treasurer and collector in 1936 and assistant general manager in 1946. During his term as general manager, many large-scale improvements have been carried through at Leith Docks, notably the creation of the new Western Harbour with its two deep-water quays, and the erection of the Caledonian flour mill there. Mr. Proudfoot is an executive member of the National Association of Port Employers and a member of the Forth Conservancy Board and the Institute of Transport.

Mr. A. Balfour Kinnear has been appointed to succeed Mr. A. J. Proudfoot as general manager and secretary to Leith Dock Commission. This appointment will take effect next February. Mr. Kinnear, who is 50, has since 1949 been law agent and assistant general manager and secretary to Leith Dock Commission, whose staff he joined in 1932. He is secretary of the Forth Pilotage Authority and a member of the Institute of Transport. Mr. Kinnear was educated at Daniel Stewart's College and Edinburgh University, qualifying as a solicitor in 1929.

Retirements

Mr. E. Halder, who has been dock superintendent at Middlesbrough since 1948 proposes to retire at the end of this year. After service with the North Eastern Railway Company, in 1924 Mr. Halder joined as a shipping clerk in the dock manager's office at West Hartlepool. In 1933, he became assistant dock agent at the Victoria Dock, Hull, served as dock superintendent at St. George's Dock, Hull, from 1945-1948, and has since spent ten years at Middlesbrough.

In addition to acting as deputy to the Middlesbrough and Hartlepools docks manager, he has been chairman of Area Councils Nos. 1 and 2 (B.T. Docks), a member of the National Council and North-East Coast Group Executive Committee of the Port Employers' Association and a member of the Area Dock Labour Board and secretary of the Middlesbrough Port Operations Panel. Mr. Halder has played a leading part in developing the educational facilities fostered by British Transport Docks and for a number of years has been a lecturer under the Dock Workers' Education Scheme.

Mr. Halder is to be succeeded by Mr. J. A. Lacey, who is at present assistant to the docks manager, Middlesbrough and Hartlepools.

The Manchester Ship Canal Company announces the retirement on October 31st, 1957, of **Mr. Norman N. Bird,** M.B.E., F.I.C.S., M.Inst.T., Manager of their Bridgewater Department.

Joining the Manchester Ship Canal Company in 1938, Mr. Bird was appointed Assistant Superintendent of the Bridgewater Department, a post he held until 1941 when he was made Manager of this Department. As Manager he was responsible for the administration of 50 miles of Canal, a fleet of barges, tugs and motor vehicles and extensive warehouse accommodation as well as the operation of Runcorn Docks.

During the Second World War, Mr. Bird was appointed Secretary of the North Western Ministry of Transport Canal Committee in 1941 until it was dissolved in 1947. He was awarded the M.B.E. in 1946 for his outstanding services in connection with this and other aspects of war-time transport.

In 1941 he became a Member of the Executive Committee of the National Association of Inland Waterway Carriers and from 1947 to 1956 he was the President of this Association. For the past ten years he has taken an active interest in the wages conditions of employment of Inland Waterway Personnel throughout the country, having served on the National Joint Council for the Inland Waterway Industry.

Mr. Bird will be succeeded as Manager of the Bridgewater Department by Mr. Alfred Hayman, A.M.Inst.T., who has been Deputy Manager since January 1st, 1957.

Modern Dry Docks: Design, Construction and Equipment

III. Siting, Design and Construction

By P. F. STOTT, M.A., A.M.I.C.E.

The Engineer's Contribution

THE design and construction of dry docks has always been a challenge to the skill and imagination of civil engineers and remains so to this day. The reasons for this are not hard to find.

First, there is the purely structural aspect which imposes a problem never easy of solution and almost invariably most difficult to solve with economy. The difficulties stem not only from the necessary proximity to open water, but from the very nature of the dock as an earth retaining and earth supported structure, soils being notoriously the most variable and their behaviour the least susceptible to rational calculation of all the materials with which the engineer has to deal. It is this unique combination of marine and land problems which marks dry docks as being in the front rank of major civil engineering works.

In spite of the technical attraction of the structural problem, however, there is another aspect of the work which offers great scope to the engineer. A dry dock is in essence an open-air workshop and as such must normally be designed with more detailed consideration of commercial purpose and utility than is usually associated with works of heavy construction. The owner's requirements may well be expressed as a general background of thought much as set out by Champness in his general survey and the development from that general basis of facilities satisfactory in detail calls for thorough conversance with the demands of ship repairing practice.

Modern techniques of shipbuilding and corresponding advances in methods for the servicing and repair of ships have brought about in recent years significant changes in the scale and form of dock facilities, but the perennial problem of the extent to which increased facilities are economically justified still remains. It is a matter which the owner alone can decide, but the range of choice of alternative provisions is for the engineer to demonstrate and in that way to play a vital part in the development of the enterprise.

Dimensions

The general survey has given a broad review of the factors which the owner will have in mind when selecting the dimensions of a new dry dock. His choice is made no easier by the fact that in most instances he has to be governed by his estimate of the needs of his business at some time in the future. It might be imagined that provision for the uncertain needs of the future would easily be made by so building a dock of size limited to serve commitments of to-day that it could be extended at a later date when the business required, the capital investment then being more closely related to demand. However, in general, such an approach is impracticable owing to the constructional problems of enlargement. Lengthening is a comparatively simple operation (if site conditions are favourable) and may be carried out without substantial interruption in the use of the dock as existing, but when the cost of establishing a temporary head wall is taken into account, the proportionate saving on the total cost due to initial shortening is not great unless the site conditions make the cost of work in the extension disproportionately high. Widening is a difficult and relatively expensive operation under the most favourable conditions, and to deepen a dock would in most cases be impracticable and, almost without exception, would be uneconomical. From the owner's viewpoint these latter operations also involve another and more serious factor in that the dock would be out of action during most of the operations. Even the largest concern can only contemplate with reluctance such an interruption of normal business.

It can be seen then that the owner will in general be well advised to build to a final size, for when compared with any suitable intermediate scheme the margin of first cost is likely to be low and the margin of overall final cost high. He will then be concerned in one of two ways—either to build a dock of optimum size for the trade envisaged at the lowest possible capital cost consistent with the provision of adequate ancillaries and facilities, or to build a dock as near optimum size as the available finance will permit. In both cases he may, by careful examination of the demands of his business, be able to influence the results by making a prudent choice of the main dimensions.

For a given length the variables are width and draught over blocks and the proportionate influence on cost of change of these factors will vary with the design adopted. The consideration of width will first be governed by the maximum beam appropriate to the length and secondly by the working space required for the various reasons set out by Champness. The scale of the cost variations will generally encourage the owner to limit his generosity to the provision of a reasonable working space appropriate to the ship of maximum beam, remembering that most of the slightly less than maximum size ships will have ample room. The variation of cost with draught being more marked than with width requires an even closer consideration of this factor. Prior to 1939 docks were either conceived as of moderate size to serve a general trade or of large size for a specific trade (generally that of passenger liners or warships). In these circumstances there was every reason for the selection of depths appropriate to the maximum normal docking draft of the largest ship capable of entering the dock. In recent years, however, the bulk carriage of oil and iron ore has developed on such a scale that tankers and ore carriers now constitute a high proportion of the world's merchant fleets and especially of vessels over 10,000 tons deadweight. This makes it likely that an owner contemplating a new dock in these days will be intending to extend his facilities to serve this trade, the trade which will determine the plan dimensions to be adopted. Many owners therefore have chosen draughts to suit their main customers, the bulk carriers, draughts generally somewhat lower than would be appropriate for a dry cargo ship of similar dimensions. Champness's Fig. 2 gives some illustration

Fig. 1. Captain Cook Graving Dock, Sydney.

Modern Dry Docks – continued

of this point for ships up to about 40,000 tons deadweight, but it must be added that even for ships of 100,000 tons deadweight it is a practical proposition in favourable circumstances to ballast to a maximum docking draught of about 27-ft. A background to this is provided by a table of theoretical minimum draughts in light condition given in a recent paper presented to the XIXth International Navigation Congress[1]. This shows that for the largest ships the figure does not exceed fifteen feet.

These considerations may not be entirely appropriate for exposed sites where poor handling conditions are likely. In these circumstances the largest vessels may require to be ballasted to reduce windage and improve stability with a consequently greater docking draught. The range of tide and the docking clearance also influence the final choice of draught; dry docks leading off enclosed wet-dock systems can usually be worked to closer limits of clearance than those of tidal waters.

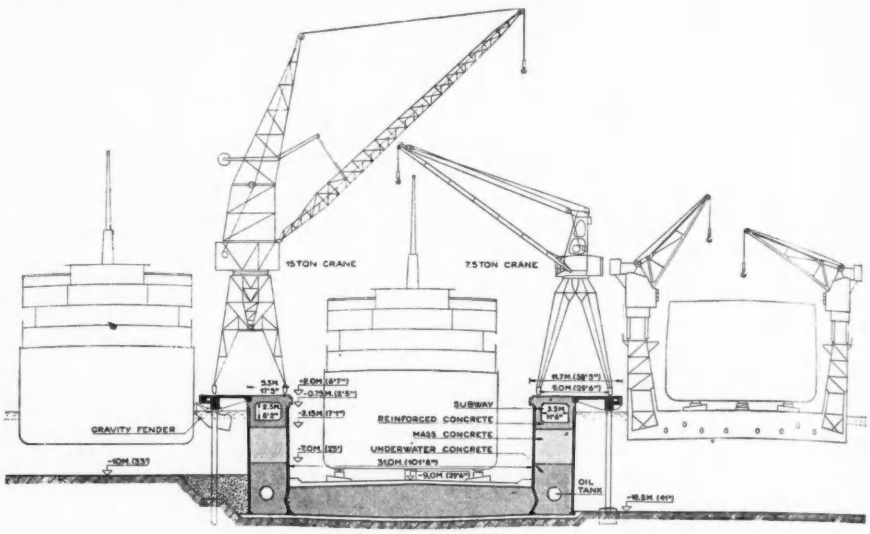


Fig. 3. Cross section of Copenhagen Dock.

The above remarks cover the commercial choice of dock dimensions. Naval docks stand quite apart as they must of necessity be constructed to serve the most extreme need of the fighting forces, the docking of damaged warships being the commonest ruling factor. The most recent development in British practice of these requirements was the construction of the strategic Captain Cook dock at Sydney[2] and the Sturrock dock at Capetown[3] both of which have a depth of 45-ft. available over blocks at M.H.W.S. It is of interest to note that a comparable provision, presumably with the extreme demands of merchant and naval vessels in mind, was made in the King George V dock at Southampton[4] where the depth at M.H.W.S. is 48-ft., the tide range being considerably greater than that affecting the two docks previously mentioned.

Siting and Layout

Although it seldom happens in these days that a new dry dock is to be established on a virgin site remote or divorced from existing facilities, there are certain engineering requirements which must form a background to the study of a particular site and whose relative importance must depend on the circumstances of a particular case. These are:

(1) A level site of adequate area, either natural or obtained by excavation or reclamation,

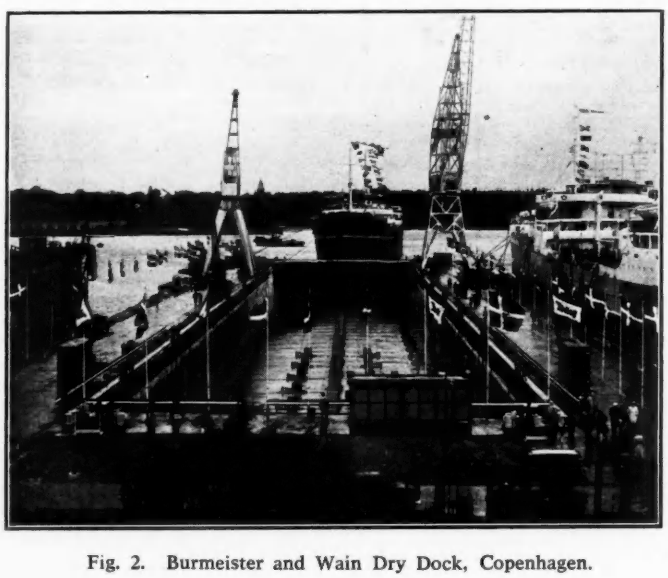


Fig. 2. Burmeister and Wain Dry Dock, Copenhagen.

(2) Satisfactory foundations available at a reasonable depth,

(3) Easy access by road and, preferably, also by rail,

(4) A repair and fitting-out berth to be available or readily provided,

(5) Existing workshops, or space for new ones in close proximity to the dock,

(6) An approach channel as short and as easily maintained as possible. Continuous and expensive dredging must be avoided.

These requirements are basic to the problem and effective compliance is necessary to a satisfactory dock system. The nearness of the approach to the ideal depends on the local situation, each site presenting its own problem and demanding its own particular layout.

At the present stage of industrial development natural sites in suitable localities are usually somewhat cramped and limited and imaginative reclamation is sometimes required to provide scope for the planning of an efficient installation. The Sydney and Capetown docks [2, 3] provide good illustrations as both sites were formed in this way. Fig. 1 is an aerial view of the Captain Cook dock, the whole of the dock area between the old shore line in the foreground and the original island in the background having been reclaimed. A fitting-out berth forming part of the scheme is close by.

Commercial developments have also been carried out by reclamation. One of the most effective additions to an existing establishment in recent years is the new dry dock of Burmeister and Wain at Copenhagen. This dock, built by methods later discussed, projects like a finger pier from the already fully developed shore line, and is flanked by fitting-out berths (Figs. 2 and 3).

In this country existing yards are usually old established on their sites and modernisation and extension to suit present needs can often be difficult and involve considerable preparatory work. On Tyneside, where past development on the river banks in the narrow valley leaves little room for growth, each of the three large docks [5, 6, 7] built in recent years has been very limited in alignment on the site available to the particular owner and even so considerable expense has been involved in satisfying even the first of the engineering prerequisites mentioned above. Indeed, few British ship repair yards have been so fortunate as to have been planned as a whole for modern conditions. One of the rare examples is the Palmer's dock yard of the Prince of Wales Dry Dock Co. at Swansea, a plan of which is shown in Fig. 4. Here, convenient and compact, are all the facilities required to serve a dry dock, and in the final substantial development now proceeding when a second dock (shown dotted) is to be commissioned a most effective layout will be completed.

Modern Dry Docks—continued

While in instances where there is considerable freedom of choice in the selection and use of a site the influences of wind and tide conditions are factors to be considered when alignment is to be settled, there is generally insufficient scope to allow the problems created to be mitigated by changes in layout. Even the provision of lead-in jetties or dolphins which can greatly assist ship control during periods of strong winds is seldom practicable owing to other navigational requirements near the dock entrance. Fig. 5 shows a view of twin docks of modern construction in Holland[8] where the provision of a substantial dolphin at the entrance between the docks is also associated with a special form of dock gate.

Site Investigation

Careful investigation of the geological formation and soil characteristics of a site are vitally necessary before a design can be commenced. A background of general methods and measurements which may be adopted is provided by a recent code of practice[9]. Preliminary and often most valuable information can be obtained from local records and these can form a general guide to the scope and location of the borings which are essential to an adequate exploration of the site.

The number of borings required to give a satisfactory account of a particular site will vary according to the nature of the ground. Sites where it is evident that uniformity is lacking, such as those where recent alluvium rests unconformably on a former rock

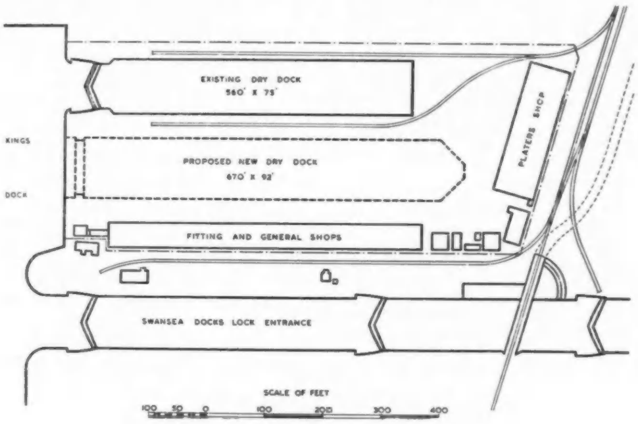


Fig. 4. Dock yard at Swansea.

surface or where boulder clay or heterogeneous alluvial deposits are met with, require a generous coverage so that on a statistical basis it can be reasonably certain that very nearly the least favourable conditions have been found. On the other hand, uniformly bedded deposits, be they of rock or soil, require only such probings as will establish the nature of the materials and any uniform variation in the various horizons, but a close study of the general locality must be made in order to establish the general presumption of uniformity.

The primary information which should be yielded by the borings will be a careful description of the nature of the foundation material. If rock, cored samples should be obtained and the borings should be extensive enough to reveal whether any degree of fissuring or shattering or other geological conditions exist which may affect the design of the dock.

Where the dock will not be founded on rock, undisturbed samples of the materials encountered should be taken and tested to determine their characteristics. The borings must penetrate substantially below the dock bottom. Deep penetration is required for two reasons: first, to prove that the lower strata are strong enough to withstand the loads transmitted from the dock, and, secondly, to ensure that, if the ground generally is not water-bearing, no water-charged stratum exists so close to the dock bottom that upward heave might occur during or after construction.

In dock practice probably the most significant observation taken during the trial borings is a record of ground-water levels.

Fig. 5. Twin docks at Schiedam.

The mean level of the ground-water will generally be mean sea level and periodic fluctuations corresponding to the tides can often be recorded, the amplitude of the variation being a function of the distance of the stratum from free tidewater and the permeability of the material. While the maximum level encountered will generally be an important factor for wall and floor design, careful enquiry is necessary to ascertain whether any change in local circumstances can conceivably result in an increase of level.

The permeability of the strata generally and any other information having a bearing on the pumping capacity necessary to control the ground-water during construction must be studied, as the dewatering of the site can be a major problem affecting both the design and mode of construction. Pumping tests may well be necessary to give a direct and reliable estimate of the position.

Dock Structure

The period subsequent to 1939 has been one of unprecedented industrial expansion. The methods and products of all industries have been improved and refined under the stimulus of competition and opportunity and the ship repairing industry and the civil engineering profession have generally moved with the stream of development. It is not surprising therefore that the present generation of dry docks represent on the whole a considerable advance on all but the most forward-looking and apt of previous designs.

None of the alterations in owner's requirements which have developed in recent years affect in a fundamental manner the basic design problem. The most radical change, that in the shape of the dock profile, has not, as might be imagined, come solely as an owner's requirement, but is the expression in terms of modern engineering methods of the new attitude of the industry engendered by developments in shipping and in repair techniques. Nearly all new docks have vertical or near vertical sides and in

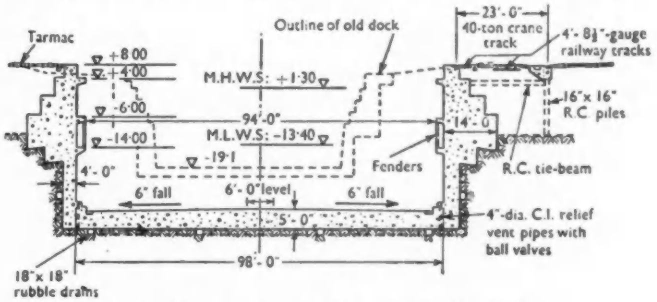


Fig. 6. Cross section of Greenwell's No. 1 Dock.

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Radio-Active Effluents and the Port Authority

A Short Examination of the Present Position

By "ANCAIOS"

For better or for worse, it is rare that any statutory anti-pollution powers are invested in a dock and harbour Authority. Such powers are, however, normally conferred upon river conservancy catchment or improvement undertakings, and these bodies are vitally, or at least primarily, concerned in the regulating of the level of radio-activity of the waters under their control, particularly in cases where the waters may be used for drinking or where fishing is important.

However, cases have arisen where it is desired to discharge radio-active wastes into tidal rivers within the jurisdiction of a dock or harbour Authority, and the frequency of such cases will no doubt increase in the future.

Factors Affecting Port Authorities

Port authorities will normally have regard to the discharge of radio-active effluents only so far as they affect the interests of the authority, and these may include:

(a) Health risks to divers working in the vicinity of "radio-active" outfalls.

(b) Health risks to personnel concerned in dredging or soundings work.

(c) Possible contamination of water boats, fuelling craft and small craft serving shipping.

(d) Possible build-up of contamination in areas which are not self-cleansing or are self-cleansing only in times of flood or exceptional tide.

(e) Possible build-up of activity in fish where liable to human consumption.

Radio-active wastes now discharged to rivers in Britain may be from Atomic Energy Authority premises, from hospitals treating patients by isotope therapy or from industrial premises and research laboratories. The A.E.A. must obtain approval to the discharge of radio-active wastes from both the Ministry of Agriculture and Fisheries, and the Ministry of Housing and Local Government. These two Ministries are the responsible authorities in Britain for authorising the discharge of activity into any water course.

The general powers of control of radio-active hospital and industrial effluent are those relating to normal chemical pollution, e.g. the Public Health Acts, the Rivers Pollution Acts, the Radio-active Substance Act and the Water Acts, and most of these acts confer powers upon local authorities and undertakings.

Data Required

A considerable volume of literature is now available upon the influence of radio-activity on Public Health Engineering Services and on Water Supply undertakings and some of this is of value to port authorities and those having jurisdiction within the tidal reaches of rivers. A short bibliography of the more important relevant papers is included at the end of this article, but no distinction between discharge into tidal and non-tidal waters has so far been advanced.

The information which must be available to a port or tidal river authority in considering any proposal to discharge radio-active effluent includes:

(a) Annual volume of radio-active effluent.

(b) Types of radio-active material that will be present in the effluent, i.e. names of isotopes, type of activity and approximate half-life.

(c) Maximum concentration of radio-active materials in the effluent, both mean annual activity and maximum transient concentration.

(d) Minimum tidal flow during neap tides, with periods and times of slack water.

(e) Actual dilution and aggregate seaward rate of flow of the waters of the river at various levels—from actual observations, the study of tidal models, or from salinity or pollution measurements.

Annual Quantity and Concentration of Radio-active Effluent

A paper entitled "Radio-active Discharge to Sewers and Rivers" (1) gives some estimated figures of the maximum level of activity of raw effluent arriving at a sewage treatment plant, and this paper outlines the effect of primary sedimentation and trickle filtering upon the concentration of the activity. Where there is no treatment of the contents of a sewer discharge directly to a river or harbour, it is estimated that a level of 1×10^{-7} microcuries per mili-litre is the most active outfall effluent at the present time.

This figure should be compared with the Medical Research Council safe figures for life-time drinking water tolerance concentrations for the non-tidal reaches of the River Thames, where the discharge over any period of one month may not exceed the published figures. However, it is probably "not realistic to insist on dilution of radio-active wastes in sewage to the level established as permissible in drinking water" (2).

It has been agreed that a quantity of 1,000 microcuries of activity can be discharged into a normal sewage drain provided the population feeding the drain is about 10,000, i.e. the daily flow in the sewer is about 300,000 gallons. The American figure for the maximum permission short-period contamination of Phosphorus-32 and Iodine-131 in sewage is 1×10^{-7} microcuries per mili-litre.

Type of Activity

The type of activity involved, and its persistence, are of importance in considering the permissible contamination levels. The most toxic active substances are radium from the alpha emission point of view and Strontium-90 from the beta emission point of view. The drinking water tolerances for these are 4×10^{-8} mc/ml and 2×10^{-6} mc/ml.

Since alpha and beta emitters are mutually exclusive, it is

Modern Dry Docks—continued

many cases, especially on the Continent, altars are dispensed with as Champness has noted earlier. However, in view of the previous remarks about modern developments it is interesting to note that even if altars are to be provided in these days they are often formed as cantilevers off vertical walls (Fig. 6) since this generally suits present construction methods whereas in the past a stepped wall was formed to provide the altars, a proceeding which suited mass concrete construction admirably.

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[9] Civil Engineering Code of Practice No. 1. Site Investigations.

(To be continued)

Radio-Active Effluents—*continued*

necessary in calculating permissible contaminations to take account of this exclusiveness by an empirical formula:

$$D=50A+B$$

Where

D=Daily maximum permissible activity discharge.
A=Alpha emission.
B=Beta emission.

The persistence of radio-activity, usually measured by the half-life of the isotope, varies very greatly, and where the tidal river has only a limited self-cleansing action, the half-life of the various substances likely to be discharged must also be considered. Hospital and industrial effluents may contain the following and other radio-active substances:

Isotope	Type of Activity	Half-life
Strontium-90	β	28 days
Iodine-131	d, β	8 days
Carbon-14	β	5,600 years
Chlorine-36	β	310,000 years
Iron-59	β, γ	45 days
Sodium-24	β, γ	15 hours
Phosphorus-32	β	14 days

Isotopes having short half-lives are therefore sometimes required to be stored in carboys for a period of about 28 days and discharged slowly (over a specified period) into the drain or sewer at a time of normal maximum flow in the sewer.

River Flow and Dilution

It is wise, where practicable, to preclude the discharge of radio-active effluent into a tidal river during periods of slack water, i.e. between one hour before to one hour after the times of both low and high tide.

In any case an assessment of the tidal flow and the self-cleansing action of the river should be made. Where the latter is known to be satisfactory, it will normally suffice to calculate the mean and the maximum build-up of activity in the river during an hourly and a twelve-hour (tidal) period during neap tide conditions. It is suggested that mean annual and maximum transient activity thus calculated should not exceed 5×10^{-10} and 2×10^{-6} microcuries per mili-litre respectively from any one source.

There is some evidence (3) that in addition to the dilution afforded by river waters, there is considerable absorption by plankton and algæ of radio-activity, but such absorption should not be regarded as an additional safety factor, as it is conceivable that a build-up of activity in the lower forms of animal and vegetable life could in itself present a hazard to health.

Where the self-cleansing action of the river in the neighbourhood of the sewer outfall is uncertain, an analysis might be made on the tidal prism and Ketchum theories, in order to determine the net tidal dilution under worst conditions of tidal and fresh-water (headstream) flow. The number of days taken for the effective transport to sea of the diluted effluent should then be used as before to calculate the maximum build-up of activity over this period.

Actual observations of dilutions and pollutions of the river and tidal waters are of the greatest value in the confident assessment of the permissible levels of radio-activity of sewer outfalls.

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O.E.E.C. Conference on Productivity in Ports

Over sixty delegates and observers from twelve West European countries, most of them from International Transport Workers' Federation affiliates, attended a conference on productivity in ports which took place in Copenhagen early last month. This conference, which was organised by the European Productivity Agency of the Organisation for European Economic Co-operation, was convened in order to discuss papers relating to the economic aspect of the turn-round of ships, working methods of the port industry, vocational training for dock workers and the social benefits of increased productivity. The European countries represented were Austria, Belgium, Britain, Denmark, France, Germany, Greece, Holland, Ireland, Italy, Norway and Sweden. Mr. E. Borg, secretary of the transport section of the Danish General and Transport Workers' Union, presided and the general secretary of the I.T.F. was also present.

At the end of the conference a statement was adopted reflecting the general conclusions which had been drawn during the discussions. In this it is stated that productivity in ports is a matter of vital concern to all elements of the community, including port labour as well as port managements and the general public. Extracts from the statement are given below.

"The delay in the turn-round of ships is reflected in increased costs of all items which members of the community utilise in their day-to-day life. Moreover, the matter of productivity in ports is a continuing problem which warrants the urgent and immediate attention as well as the concerted effort of all groups who earn their livelihood in the port industry. With the increase of mechanisation in all means of transport, it becomes increasingly necessary for the port industry to provide a satisfactory level of economic well-being for those who make their living in or around the docks and to encourage the adoption of such economic practices as will enable maritime transport to remain competitive with other forms of transport.

"This implies a concerted effort on the part of labour and management to provide labour with the most modern equipment, effective planning and co-ordination between docks and hinterland, as well as the instruction and training of all personnel involved in the full utilisation of the machinery at their disposal.

"Reasonable efforts on the part of dock labour to improve their performance and thereby their earnings should not be impeded by the failure of management to provide them with the most modern machinery and the most efficient form of planning and layout. It has been observed at this conference that a dock labourer cannot be expected to work harder to-day unless he is reassured of a job to-morrow. This involves a continuity of employment, under modern and safe conditions, which is an accepted practice in virtually every other industry."

Agreement has been reached on a number of guiding principles which, it is felt, could be conducive to achieving the desired objective of speeding up the turn-round of shipping. The statement continues that to attain this goal the following recommendations were agreed:—

"Measures to increase productivity should place emphasis on better organisation, better methods and equipment, and better training of dock workers, with due regard not only to improved productivity but the social conditions of the dockers as well. In the light of the foregoing it would be desirable to set up management-labour committees in ports where they do not exist already, for the purpose of achieving the above objective. Dockers' unions should be consulted at all levels in connection with measures for increasing the productivity of dock labour. The savings in costs should be used by management not only for providing more modern and better machinery, but also for improving the wages and/or working conditions of the workers concerned.

"There should be the greatest possible regularity and security of employment and fairness in the methods of engaging labour and allocating work, including adequate compensation in case of involuntary unemployment, redundancy and retirement, having regard to the local situation in the port industry."

Manufacturers' Announcements

Arbed Belval Steel Piling

We have received a copy of the new catalogue which has been issued describing the range of Steel Piling designed and produced by the Belval Works of Aciéries Réunies de Burbach-Eich-Dudelange, Luxembourg.

This excellently produced work of some 75 pages is bound in a handsome and very practical loose-leaf cover, and contains much interesting information on all aspects of the use of Steel Piling. From the technical information given, concerning the Belval Sections, it would appear that these compare very favourably throughout their range with others as to weight/strength ratio, and from the many photographs reproduced it is apparent that the Piling has been used successfully in many countries throughout the world.

We understand that copies of this catalogue and also of an abridged version for general use will be sent to all interested parties on application to the Columeta Export Company Limited, 19-21, Catherine Place, London, S.W.1.

VHF Radio for Port of Southampton

The Southampton Harbour Board has awarded a substantial contract to Marconi's Wireless Telegraph Co. Ltd. for equipping the Port of Southampton Operation and Information Service with frequency-modulated VHF radio. The equipment will conform to the standards laid down at the Hague Convention of January last and will form the basis of a new system of port communications that may eventually have a world wide application.

The order includes five 25 watt F.M. VHF transmitters, Type HX86A and five F.M. VHF receivers, Type HR86A, together with associated remote control equipment. The transmitters and receivers are capable of operation on any one of six adjacent channels, any of which may be selected at will from a control centre sited at a convenient point in the area. Three seven-channel F.M. VHF mobile equipments, Type HP86B, and two automatic mains/standby engine-alternator sets are also among the items to be supplied.

New 26-ft. Pilot Launch

The British Phosphate Commissioners recently accepted delivery of a 26-ft. light alloy Pilot Launch for general service at Christmas Island, Indian Ocean. The launch was designed and constructed by Universal Shipyards (Solent) Ltd., Sarisbury Green, near Southampton, Hants, and is based on their standard 26-ft. Two-way Tension Hull design. She is constructed of 12 SWG light alloy to Specification N.S.5, and is powered by a single diesel motor, developing 52 h.p. at 2,250 r.p.m., which gives a service speed of 12/13 knots. For use in connection with the deep sea moorings at the Island, the craft is equipped with an Echo Sounder and has also been fitted with lifting rings as it is necessary to bring all light craft ashore during bad weather periods.

Heavy rubber fend-off is fitted to prevent risk of damage when laying alongside vessels at the moorings. The decks, which are of positive grip plate light alloy, have been kept as wide and as free of encumbrances as possible to facilitate boarding and buoyancy material has been fitted under the side decks.

New Crane on the Thames at Bankside

The first of two level-luffing jib cranes, with new and interesting points of design, has recently been erected on the Thames at Bankside.

Important features of these cranes, which are of Babcock and Wilcox Ltd. design and manufacture, are their high output, simple operation and low and easy maintenance.

The design of the crane, though characterised by a modern approach, still retains the well-proven features of the already established Babcock construction. Notable developments in the new crane are the extensive use of welding in the manufacture of the pedestal and tubular jib and lever, simplified balancing and luffing gear, an independent centrally-positioned driver's cabin affording wide operating vision and manipulation, and an armchair control unit.

Level-luffing is still achieved by the characteristic jib and lever, or "swan neck," supported by fixed guy rope, as the advantages of this design, with the hoist rope passing direct from load to barrel without intermediate reeving, are well known. The hoist rope is short and remains inactive during luffing, and the free length is kept to an absolute minimum at all radii, ensuring a steady load and reducing any tendency to swing.

The jib and lever is of tubular all-welded construction. Balancing of the jib is by a connecting link from each side direct to the counterbalanced drive-arms, thus considerably reducing the number of fulcrums of the older designs. Drive is through spur gearing, the primary motions of which are totally enclosed in a cast-iron gear case. This motion has proved to be fast and highly efficient, with correspondingly low power consumption. Furthermore there is no tendency for the jib to run either in or out.

The jib foot-pins have been raised, enabling the driver's cabin to be placed centrally and separate from the machinery house, to which access is obtained through a sliding door. The cabin has been made spacious, and provides an unrestricted view for the driver. He is placed well forward in an armchair control unit, which enables the operator to control all motions of the crane conveniently and rapidly by levers. In this unit the drum-controllers are mounted horizontally and are easily accessible for maintenance.

View of 1¼ ton stationary level luffing jib crane.

The main slewing rack together with path and live ring of tapered rollers is mounted on a pedestal, each leg of which is constructed of mild-steel plate, continuously welded at the seams to form a closed triangular box section.

Priming Paint for Wet Surfaces

A new primer, for application to moist concrete, asbestos, cement, plaster, brickwork, and other similar surfaces, announced recently is known as "Pitan M.C. Primer." It contains a special chemical which reacts with the moisture and converts it into a harmless liquid which rapidly evaporates from the paint film leaving the surface and paint absolutely dry.

It can be applied over existing paint which has become moist due to contact with water provided that the existing coating is in good condition and firmly adherent. The primer, which can be

Manufacturers' Announcements—continued

supplied for either brush or spray application and is in a light shade of neutral grey, is touch dry in 30 minutes and hard dry overnight.

The manufacturers, Allweather Paints Limited of Gt. Queen Street, London, state that when painting newly rendered surfaces about 10 days should be allowed to elapse prior to the application of the primer in order to permit adequate carbonation and hydration.

The coverage obtained depends on the porosity of the surface. It is claimed, however, that generally speaking, a coverage of 30 to 35 square yards per gallon may be assumed for a bare surface of average porosity. On a surface already painted a coverage of 40 to 50 square yards can be expected.

New Twin Screw Triple Grab Hopper Dredger for Mersey

A new hopper dredger, the "Mersey No. 41," has recently been completed for the Mersey Docks and Harbour Board. This dredger has a length B.P. of 225-ft. 6-in., breadth of 40-ft. 6-in., draft of 14-ft. 3-in. and a hopper capacity of 1,350 tons. It is fitted with three Size 50 Priestman Brothers electric grab cranes,

New Hopper Dredger, the "Mersey No. 41."

the spoil being discharged into the hopper, the bottom opening doors of which are controlled by hydraulic cylinders placed vertically above each pair of doors.

The propulsion machinery consists of two Ruston & Hornsby pressure charged uni-directional diesel engines, driving propeller shafting through scoop controlled hydraulic couplings and modern wheel drive reverse reduction gearbox. Electrical power for all purposes is supplied by two 250 k.w. generators and two 20 k.w. generators have been installed for harbour duties. The hopper dredger was built for the Harbour Board by Messrs. Ferguson Brothers (Port Glasgow) Ltd.

Pneumatic Grain-Discharging Plants in Canada

The Canadian National Harbours Board have recently issued contracts totalling over a million dollars for eight large pneumatic suction plants, six at Montreal Harbour and two at Quebec, to discharge bulk grain from ships' holds into storage in export granaries. These will be the first major pneumatic plants ever built in Canada for discharging grain ships.

The contracts arise from port developments to accommodate the reorganised traffic conditions of the St. Lawrence Seaway. The pneumatic plants will operate in conjunction with the bucket-elevator "marine legs" which unload grain from the more accessible parts of the holds: the flexible pneumatic suction pipes will unload the substantial proportion of grain lying in parts of the holds which cannot be reached by marine legs, a cleaning-up operation for which power shovels have hitherto been almost invariably used in North America. Engineers have for many years advocated to Canadian authorities the superiority of the pneumatic system over power shovels in efficiency and economy, and these contracts therefore mark a notable advance in the technique of unloading Canadian lake ships.

The eight pneumatic plants will have a combined unloading rate of about 2,500 tons of grain per hour, and from the point of view of discharging capacity they represent (as far as is known from available records) the largest single order for pneumatic plants ever placed by any harbour board or port authority. The contracts have been received by Simon Handling Engineers Ltd., Stockport through their Canadian company, Simon Engineering Companies of Canada Ltd.

Protective Coating for Plans and Documents

A synthetic resin emulsion made especially for coating all types of paper with a transparent colourless protective film was announced recently.

Applied with a brush, spray, roller or by immersion, the fluid dries in five to ten minutes and is claimed to bond with the paper surface so that the paper becomes resistant to water, oil, finger marks and dirt of all kinds. The surface is completely washable and any dirt can be quickly removed by soap and water, petrol or paraffin. The coating is unaffected by age.

It should be of considerable use for the protection of papers being constantly handled or exposed to the weather such as civil engineering plans and drawings, blueprints, maps, notices, labels etc.

The fluid is known as "Pitaplan" and is manufactured by Caulking Services Limited of Great Queen Street, London.

Code of Practice for Site Investigations

British Standard Publication CP. 2001 : 1957

This 124-page illustrated publication brings up-to-date Civil Engineering Code No. 1 (originally published in 1950 by the Institution of Civil Engineers). It deals mainly with the investigation of the suitability and characteristics of sites as they affect the design and construction of civil engineering works and the security of neighbouring structures, but not with wider social and economic considerations affecting the community at large.

The recommendations mainly apply to conditions existing in the British Isles, although occasional reference is made to conditions overseas where this was thought desirable.

The Code starts with a section dealing with the definitions, descriptions and classification of soils and rocks. The section includes a fold-out summary "Basis for field identification and classification of soils."

"General considerations governing site investigations" is very fully dealt with under the following heads:

(a) Types of site investigation
(b) Site exploration
(c) Methods of sampling
(d) Fields tests in situ.

The appendices convey by means of text, drawings and tables a vast amount of information ranging from the highly technical to that having a useful reference value (such as the section on maps, charts and other data published by government departments).

An important appendix is that which summarises information to be obtained concerning sites for civil engineering works; and its complement "Special information required for design and construction." Another appendix contains a 2-page table "Classification and characteristics of soils for roads and airfields." Again, a section on field tests is supplemented by very full information on the taking, handling, examination and testing of soil samples.

Copies of the Code may be obtained from the British Standards Institution, Sales Branch, 2, Park Street, London, W.1. Price 20s.

APPOINTMENTS VACANT

TYNE DEVELOPMENT COMMISSION

The Tyne Improvement Commissioners invite applications from qualified persons for the position of Senior Assistant Engineer under their Chief Engineer, Mr. R. B. Porter, M.I.C.E.

Applicants must be Chartered Civil Engineers with extensive experience in the design, construction and maintenance of dock and harbour works and installations, including the preparation of estimates and contract specifications and drawings in connection with new works schemes. Mechanical experience is desirable though not essential.

Salary will have regard to the qualifications and experience of the successful candidate.

Applicants must not be less than 32 years of age nor more than 45 years of age on the 1st January, 1958.

The person appointed will be subject to the provisions of the Commissioners' Superannuation Scheme; will be required to reside in the district and to devote himself exclusively to the service of the Commissioners.

Applications on a prescribed form, copies of which may be obtained from the undersigned, will be received up to the 17th December, 1957, and should be addressed to the Secretary in an envelope endorsed "Senior Assistant Engineer."

Canvassing will be a disqualification.

Bewick Street, Newcastle upon Tyne, 1.

R. N. EGGLETON, Secretary.

ADEN PORT TRUST

The Board of Trustees invite applications for the post of MAINTENANCE SUPERINTENDENT, not more than 40 years of age, who will be in charge of the workshops, tugs and other floating plant. He should be a well qualified Mechanical Engineer having served an engineering apprenticeship and being in possession of a 1st Class (Steam) Ministry of Transport Marine Engineering Certificate or have a Steam endorsement to a First Class Diesel Certificate or hold a university degree in Mechanical Engineering.

Salary of the appointment is £1,900 x £60—£2,440 per annum under agreement. Free unfurnished quarters and medical attention. Gratuity or Pension Fund.

For full details apply to Personnel Dept., Consulting Engineers and Agents, Aden Port Trust, 1, Lygon Place, Grosvenor Gardens, London, S.W.1, or telephone Sloane 0431.

ADEN PORT TRUST

The Board of Trustees invite applications for the post of ASSISTANT MAINTENANCE SUPERINTENDENT, not more than 36 years of age, who should have served a recognised engineering apprenticeship and should possess a 1st Class (Steam) Ministry of Transport Marine Engineer Certificate. Preference will be given to candidates with a combined 1st Class Steam and Diesel Certificate who have had workshop experience since qualifying; such candidates will be considered for a higher starting salary.

Salary of the appointment is £1,450 x £50—£1,950 per annum under agreement. Free unfurnished quarters and medical attention. Gratuity or Pension Fund.

For full details apply to the Personnel Dept., Consulting Engineers and Agents, Aden Port Trust, 1, Lygon Place, Grosvenor Gardens, London, S.W.1, or telephone Sloane 0431.

NIGERIAN PORTS AUTHORITY has vacancies for TRAFFIC OFFICER INSTRUCTORS. Men of matured experience aged 45 or above or with at least twenty years' practical experience in quay/shed work in a large scale port organisation.

Applicants must be of a keen and energetic disposition and have requisite capacity and temperament for training Nigerian Staff. Knowledge of all aspects of cargo handling essential, including some years' practical and supervisory experience in shed/quay work, customs and other documentary procedures and the use of mechanical handling equipment.

Successful candidates will be appointed on a contract basis for two or three tours. Salary will be £2,200 per annum consolidated with eligibility for a gratuity at the end of the period of service.

Tours normally 12—15 months. Leave on basis of seven days for every completed month of service. Free first-class passages for officer and wife. Additional passages and allowance for children. Furnished accommodation at reasonable rental. Car allowance and free medical attention.

Write to the Crown Agents, 4, Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience and quote M3B/43712/DU.

JUNIOR ASSISTANTS required by London Consulting Civil Engineers specialising maritime works; land and hydrographic surveys, design, estimating, etc. Interesting work, good prospects, pension scheme. Apply Box No. 201, "The Dock and Harbour Authority," 19, Harcourt Street, London, W.1, stating qualifications.

TENDERS

BOARD OF MANAGEMENT FOR THE PORT OF RANGOON

DEVELOPMENT OF RANGOON PORT. Civil Engineering Contract No. 2. Transit Sheds, Warehouses and Workshops. Notice is given that the closing date for the above contract has been further extended to 12 noon on Saturday, 7th December, 1957. WIN PE, Chairman.

FOR SALE OR HIRE

HUDSWELL CLARKE 0-6-0 STANDARD GAUGE STEAM LOCO, in good condition.—Apply, Eagre Construction Co. Ltd., Scunthorpe, Lincolnshire. Telephone: 4513 (7 lines).

FOR SALE

UP TO 300 TONS NO. 5 SECONDHAND BRITISH LARSSEN SHEET STEEL PILING available for disposal. Lengths mainly 35-ft.—45-ft. All offers to: Peter Lind & Co. Ltd., Tufton Street, Westminster, S.W.1.

2-TON SMITH (RODLEY) ELECTRIC TWO-ROPE GRABBING CRANE (no grab) 40 foot lattice jib. Stationary on girder structure below slewing ring (formerly mounted on pontoon). In first-class order but cheap to clear. Darenth River Aggregates Ltd., Main Road, Sundridge, Near Sevenoaks, Kent. Tel.: Brasted 255/6.

WANTED

Back Numbers of "The Dock and Harbour Authority." February, May, December 1955; March, April, May, June, July 1956. If you have copies available, please write to Box 197, "The Dock and Harbour Authority," 19 Harcourt Street, London, W.1.